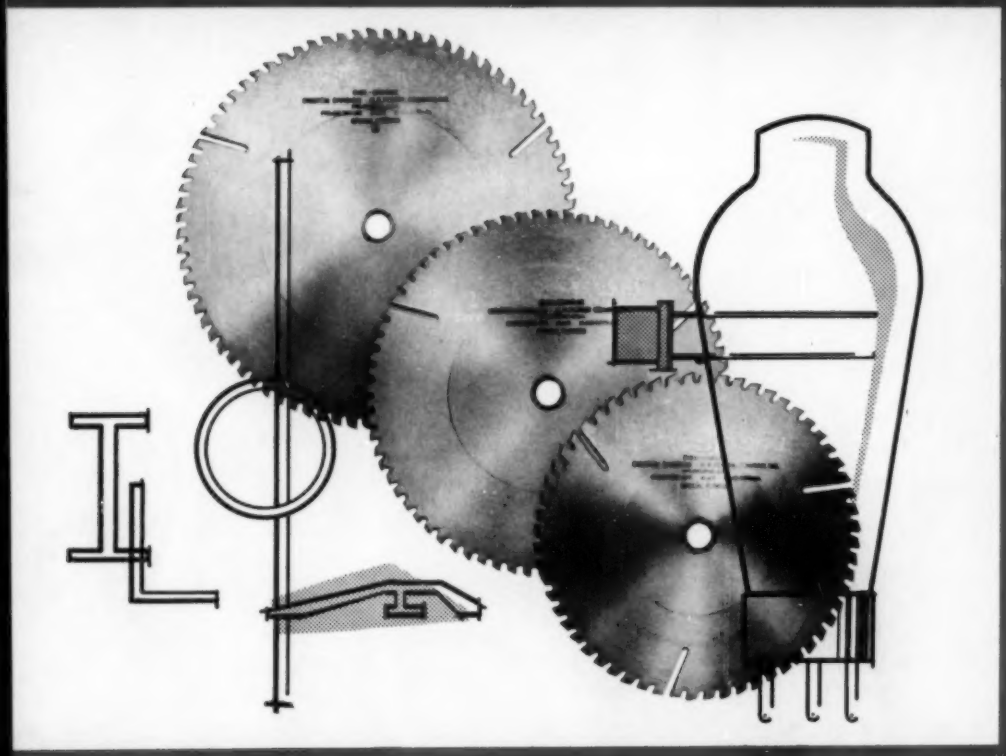
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

IAVE



a portfolio of project ideas in wood, metal, electricity, etc.

(see page 34)

- The Future Role of the Project
- The Group Project as a Beginning I-A Experience, Young
- Nine Criteria in Project Selection, Berry

October, 1960

SHOP PROJECTS ISSUE

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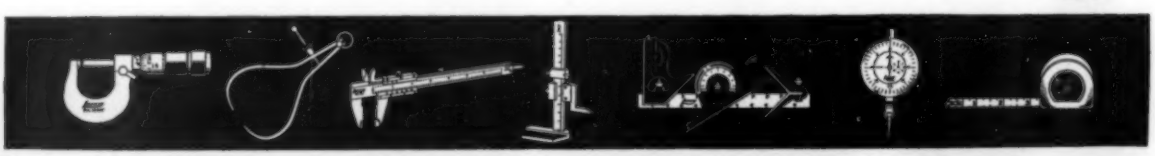

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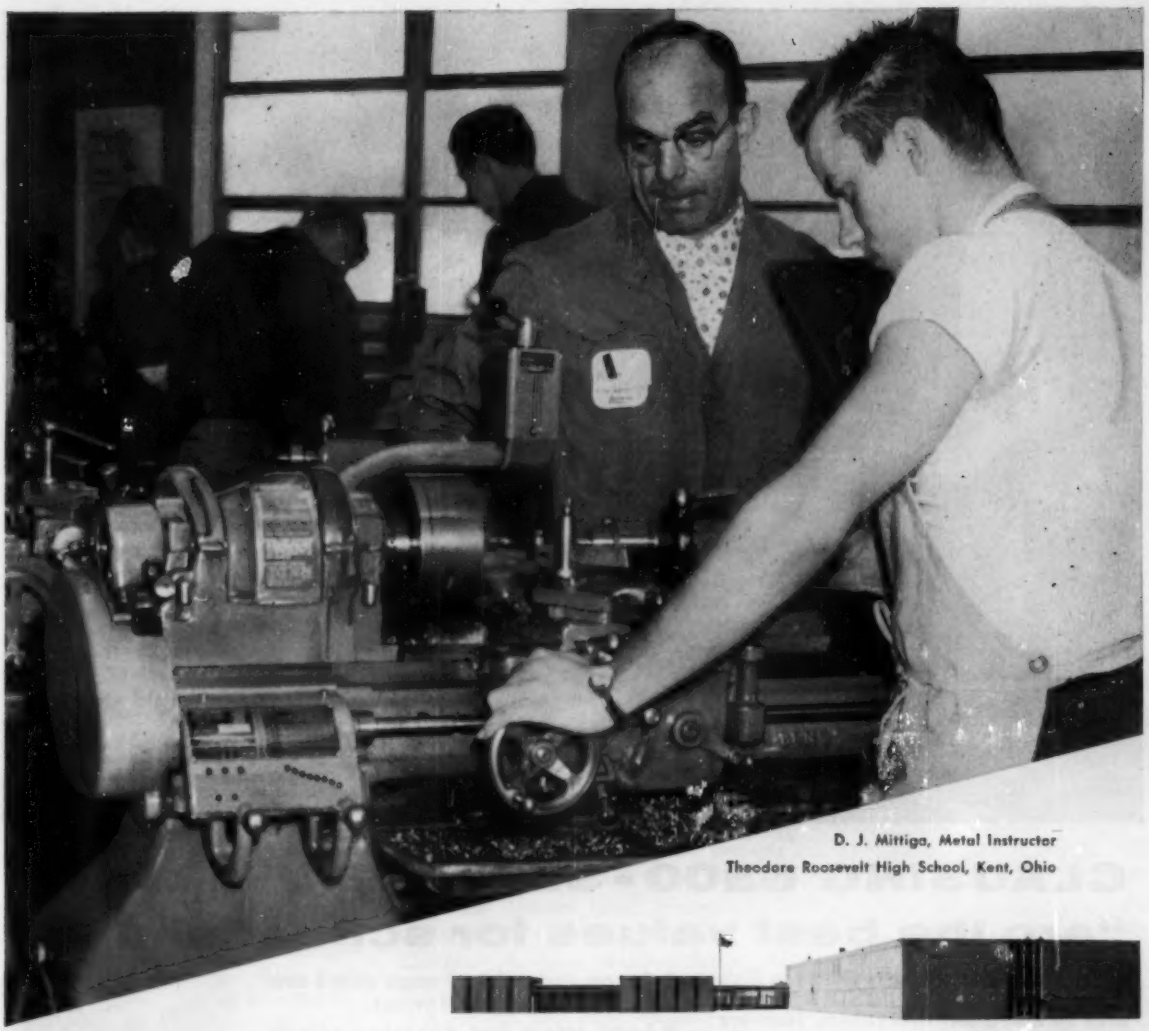

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IA/VE

Vol. 49, No. 8 / October, 1960

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your IA/VE for October

The project, core of industrial arts programs, is spotlighted in your IA/VE for October with (1) a portfolio of "how-to" articles on vital phases of planning and techniques and (2) an array of 16 project ideas which we believe you'll find helpful during the coming school year.

Among the features:

1. A *symposium of thoughts*, by leaders in the field with a special interest in the project, *on what can be done to improve project presentation* (pg. 24) in your shops to build stronger industrial arts courses. You'll find these comments point up existing weaknesses and make suggestions toward building a more promising "future" for i-a projects.

2. Try a group project as a beginning i-a experience and you'll start your students off with an awareness of problem-solving techniques in their project-activity efforts, according to the author of a detailed consideration (pg. 27) of *one way to integrate the theory* (*orientating youth of industry*) *and practice* of industrial arts.

3. *Selecting the right projects* can add considerably to an effective i-a program and the nine guidelines (pg. 30) comprise an excellent yardstick for you to use to measure your students' projects.

In addition, there are four more professional articles on the project, plus a *presentation of project ideas in depth* in electronics (pg. 34), metal (pg. 42), plastics (pg. 46) wood, (pg. 47), graphic arts (pg. 50), and drawing (pg. 51).

Also, please don't forget the *regular departments* — especially the "then and now" column (pg. 20) which reviews changing attitudes toward the project in past years, and the "notebook" column (pg. 68) which provides related data on modern coated abrasives.

for November . . .

An area of great promise in industrial education, which is still quite neglected, is power mechanics . . . and your IA/VE for November will begin a new series of articles on the why, how, what, and when of this subject.

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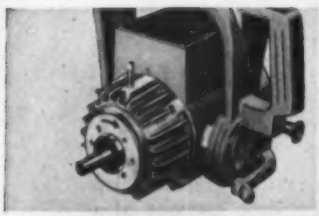

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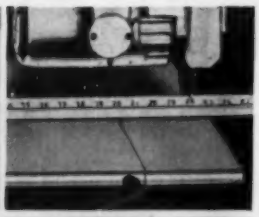

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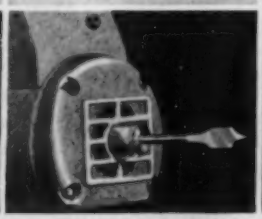

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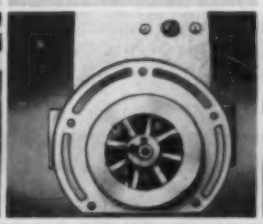

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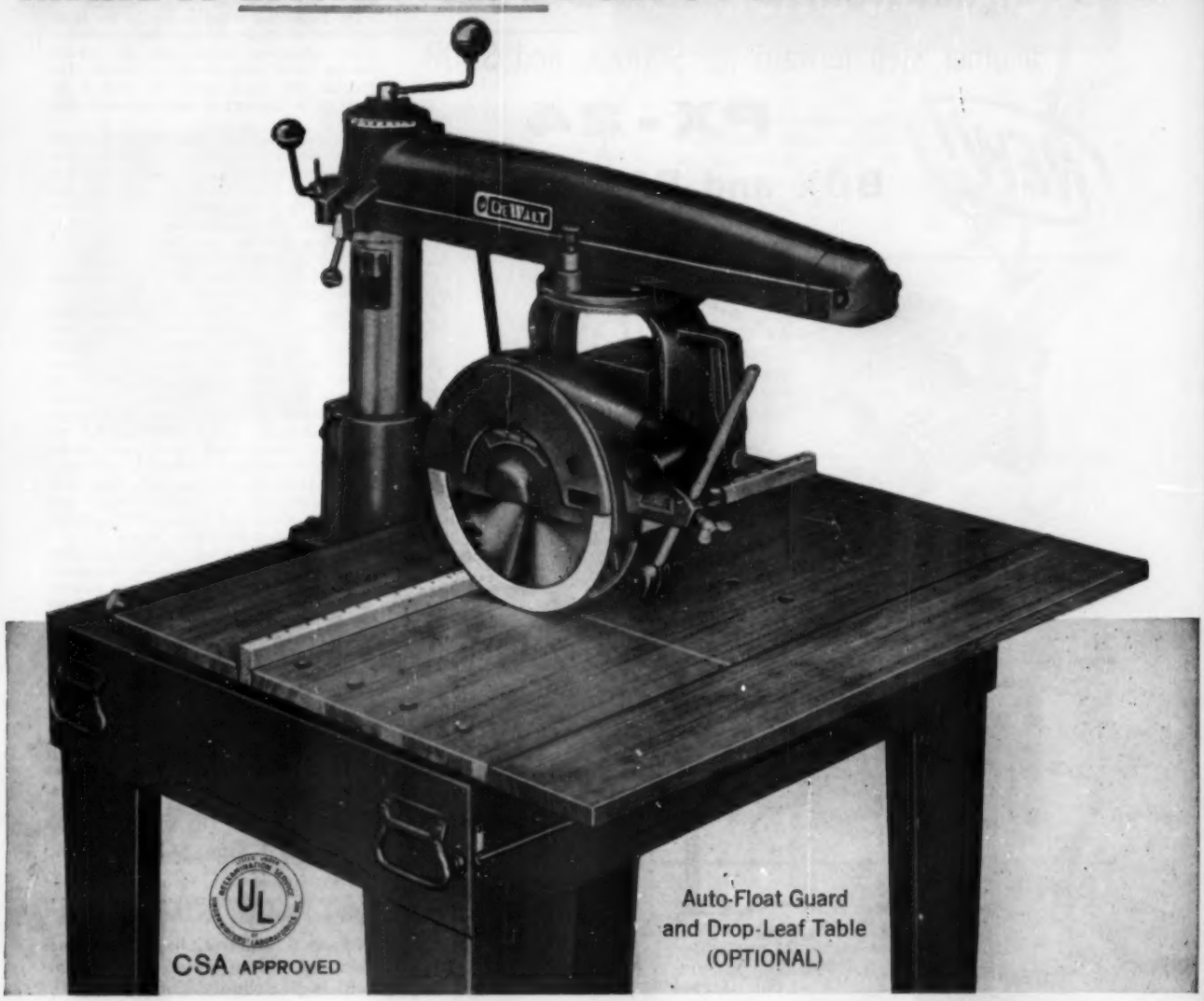

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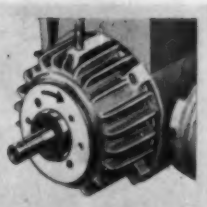

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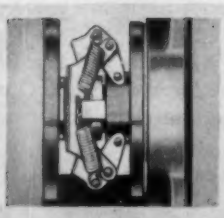

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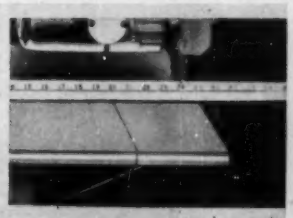

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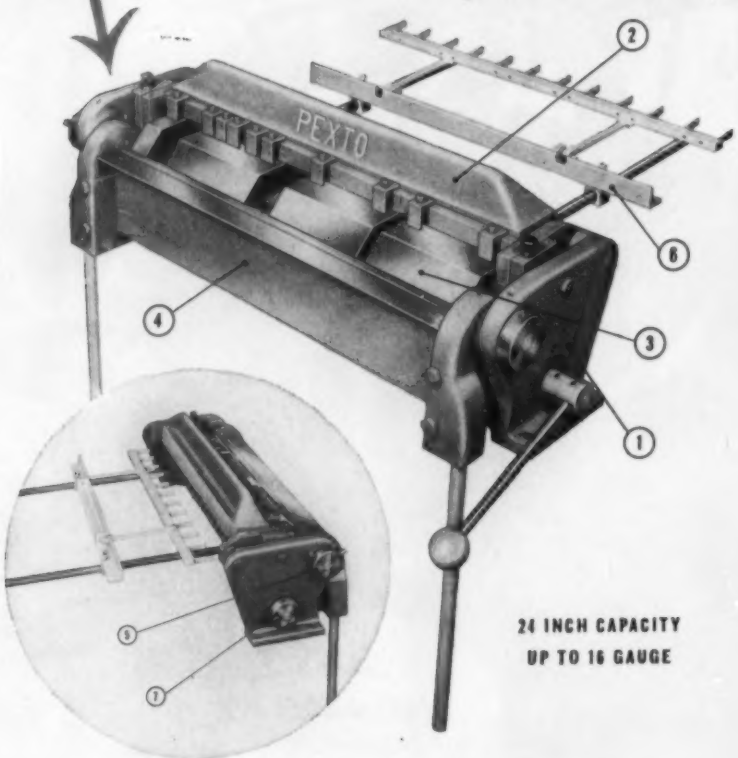

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letters

on the new look

Dr. Duffy has taken a step in the right direction to close the gap that exists between technology, engineering, and science (see pg. 14 of your IA/VE for April). Industrial arts must strive to awaken to its place in teaching in this ever widening gap.

The facts indicate that science is overtaking the technological courses and they are being dropped from the curriculum for engineers. I would like to suggest, that because of the increased demand in mathematics and physics, the present curriculums produce a scientist with little of the old engineer we have known. The descriptive technical courses have definitely decreased in all engineering curriculums.

These facts serve to drive home the importance of the technician as an important part of the training in a multileveled program. Industrial Arts must recognize the multileveled program is its key to preparing young men to better serve industry, science, and technology. The technician group will increase by leaps and bounds with the decrease of the descriptive technical courses in all engineering curricula. The gap will widen even greater between the skilled worker and engineer and one will be less able to understand the other than ever before.

Industrial education, therefore, must awaken to the need of providing the multileveled program to achieve a new interest in industrial arts and a greater emphasis on technological courses in our college work to provide a good teacher for the technical institutes. The need for technical institutes will increase tremendously in every state as the industries of our nation find the acute need for the technician to bridge the widening gap.

Richard L. Burns, instructor of engineering drawing, School of Mines and Metallurgy, University of Missouri, Rolla

on four bare walls

I am very much in favor of a monthly review of changing attitudes toward vital problems in industrial education.

Nelson S. Maurer, head of industrial arts department, Colonie Central High School, Albany, N. Y.

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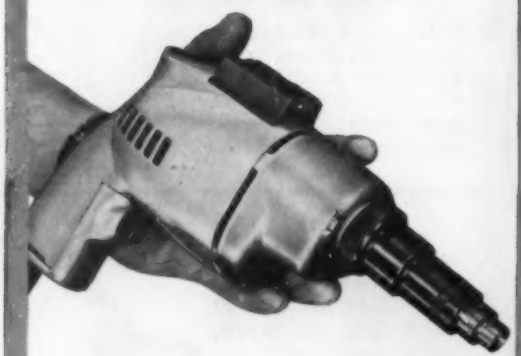

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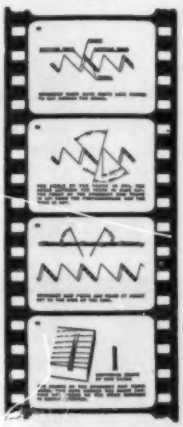

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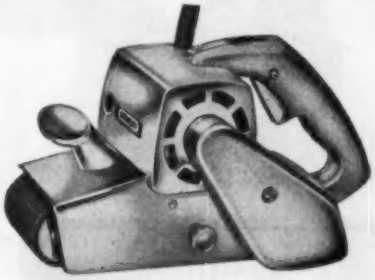

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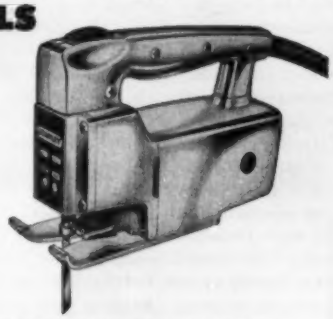

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opinion

SHOULD THE MAJOR PURPOSE OF SHOP WORK IN THE SENIOR HIGH SCHOOL BE INDUSTRIAL ARTS OR VOCATIONAL IN NATURE?

Dr. Conant in his study of the comprehensive high school has pinpointed the vital contribution industrial education makes to this heterogeneous grouping of students of this type of high school. However, his study fails to consider any aspects of the vital question for school planners of whether the accent of this industrial study should be industrial arts or vocational in nature.

Asked this question, a list of IA/VE readers (teachers, supervisors, and teacher educators selected at random) voted strongly (75 per cent) for major emphasis on industrial arts in the curriculum of the comprehensive senior high school.

Concerning this question, a teacher educator, voting for industrial arts, justified his choice by stating that "Industrial arts reaches more youngsters; it gives a background for numerous areas of work or further formal education; and (it) has many other attributes for general education of people." The respondent believed a guide toward this emphasis should vary with the size of the school — as the school becomes larger, a "good general industrial arts program should precede a more specific type of program in industrial arts with a good trade or vocational program added as justified."

A city school district supervisor of industrial education indicated, in voting for industrial arts, that "it has been our experience that the industrial arts background affords experiences that are contributing factors in deciding on a trade or vocational objective after graduation from high school."

Should the Major Purpose of Shop Work in the Senior High School Be Industrial Arts or Vocational in Nature?

Yes 75% No 25%

Two teachers, who voted for vocational education emphases in senior high schools, believed (1) "I find the schools in which I have visited (in Alabama and Tennessee) to be in need of more specialization" and (2) "I feel that a good background of training in a particular vocation would enable a person to make a livelihood even if he planned on going to college."

Several respondents, after referring to the element of varying local conditions, called attention to what additional local post-high facilities were available as a determining factor. "In a situation," one industrial education teacher educator wrote, "where many or most of the pupils will have an opportunity to go on into a 13th or 14th year of schooling, the vocational training might well be placed at these levels, so the major purpose of the shop work in senior high here should be industrial arts in nature. In another situation, where only a few pupils might have the privilege of training beyond the senior high level, the major purpose of shop work in the 11th and 12th grades could very well be vocational in nature, but I would vote for an industrial arts type of program at the tenth grade level following up whatever I-A training students may have received in a junior high school."

Another comment in this vein is "The trend apparently is toward less vocational preparation and more industrial arts. This is probably due in large measure to the greater amount of training and skills required in the occupations of the future. As quantity and quality of training increases the amount of time necessary to do this will expand upward into grades 13, 14, and higher." ◀

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Logan

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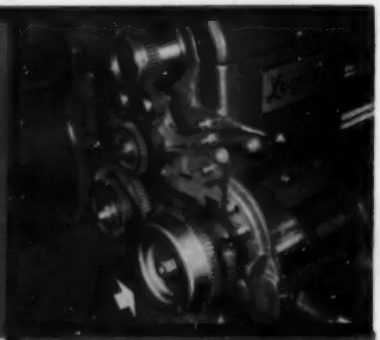

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You may try the new Model 200 Foley Saw Filer in your own shop for 30 days. See for yourself its precision work, advanced design and quality construction—time-proved through more than 50 years manufacture and use of previous models. Write for literature and details of 30-day trial offer.

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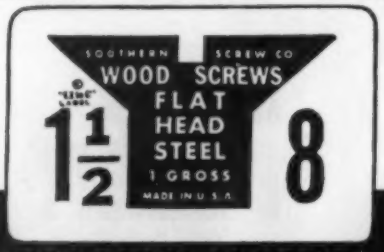

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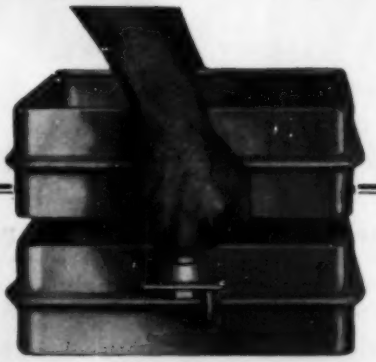

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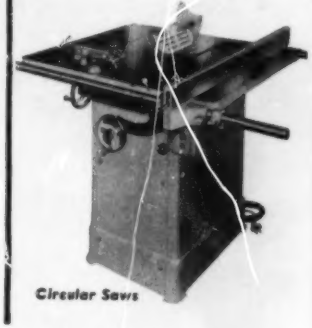
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The NEW U. S. MILLRITE

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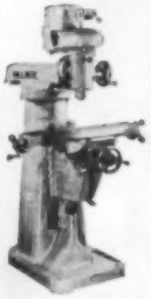

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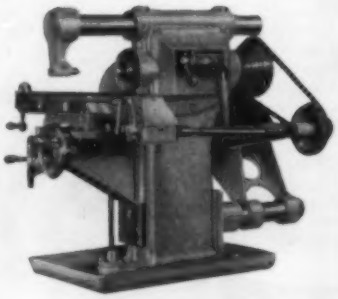

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news

voc-ed status There were 3,701,121 vocational students in 1959, an increase of over 70,000 or 1.9 per cent over the previous year, according to a report of the vocational education division of the Office of Education. According to type of program, the enrollment was distributed, by thousands: 1,585 to home economics; 968 to trades and industry; 757 to agriculture; 310 to distributive occupations; 48 to area programs; and 30 to practical nursing.

Expenditures for voc-ed totalled $228,314,600, an increase of almost 20 million dollars over 1958. Of the 1959 total, local sources expended $107 million; state, $79 million, and federal, $41 million.

Mitchell: "Stay in school" Unprecedented job opportunities await young Americans in the coming decade, according to Labor Secretary James P. Mitchell in an open, "stay-in-school" letter to students. But to get and hold these jobs, he advised, they need "all the schooling and training they have the capacity to absorb." In his letter, Mr. Mitchell pointed up his department's studies indicated that the '60's will bring about a 40 per cent increase in job opportunities in the professional and technical fields, areas which require additional years of training.

confer on improved T & I teacher training With emphasis on development of leadership qualities and competencies in teacher training, the 1960 National Leadership Development Conference in Trade and Industrial Education provided industrial educators with opportunities to meet with visiting resource specialists from industry and education and to undertake practical projects in line with conference objectives. The meetings were held August 8 to 19 at Stout State College, Menomonie, Wis., under the supervision of John P. Walsh, director of the trade and industrial branch of the U. S. Office of Education.

photo contest open The 1961 Kodak High School Photo Awards are now open and information on who's eligible, dates, what kind of pix, subject matter, how many entries, approval, and the actual awards can be obtained by writing Miss E. M. Brearley, supervisor, Kodak High School Photo Awards, Rochester 4, N. Y.

trends in home building The results of research on building trade classes in Illinois schools were reported by Alfred E. DiPietro of Southern Illinois University. Twenty of the twenty-seven instructors mailed a questionnaire stated that they had active building programs at the time. The twenty schools were placed in categories according to the population of the town they were in. Divisions at 5000; 15,000; and 25,000 distinguished four groups.

The total report of the 20 schools indicated that 144 homes have been completed, of which about two thirds are three-bedroom houses and the rest two. Three one-bedroom buildings are included in the total. The majority have garages; all those built by schools in the upper two population groups have them. Two schools in the lower groups have carports on most of their homes, and two have neither on most of theirs.

The majority of the programs complete a house in two years. Decatur leads production with two homes a year.

(Concluded on page 73)

"The best equipped aviation school in the country," is a claim made for the Dade County Board of Public Instruction's Aviation School. The school's two general divisions enroll 400 high schoolers and 400 night school adults. In the high school course, three hours per day are spent at the school with the rest of the student's time being devoted to basic courses in mathematics, science, and the humanities at the "home" high schools.

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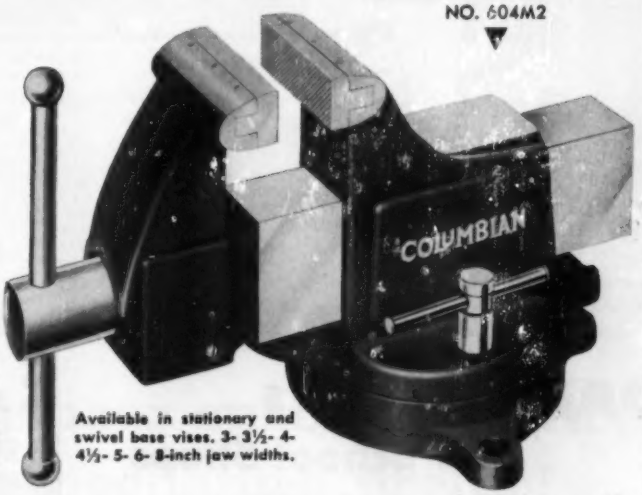

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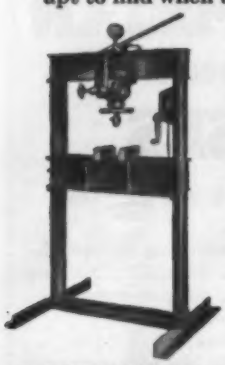

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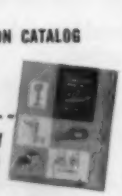

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THE PROJECT: FRIEND OR FOE?

Ever since the early days of industrial arts, our leaders have felt that students are motivated to a greater extent by useful projects than by the "exercises" of the manual-training era. However, the controversy has raged around the question of whether this same project is friend or foe. It is interesting to look back through the issues of IA/VE to see what has been said about the project and its place in our instructional programs.

Thirty Years Ago

In the January, 1929, issue of The Industrial Arts Magazine (earlier name of IA/VE), Emerson Manzer stated "the pupil is the product of the shop and of our teaching — the project, whether it is merely a bread board or a beautiful center table, is just a by-product. *But even though it is a by-product, its importance in the 'pupil-project-teacher' combination is one of keystone significance.* If our objectives are going to be in terms of boy attributes and boy accomplishments we must turn our attention to another paramount issue in our particular field. The problem of choosing projects for shopwork is one that goes hand in hand with the problem of keeping shopwork up to the present accepted standard. If we recognize the project as the keystone of our structure, we can continue to build safely upon the present foundation provided:

1. That the choice of projects be such that they will aid in the achievement of the major and minor objectives of their specific activity.
2. That the project be of such nature that it will afford opportunity for related subject matter.
3. That the project be of such nature that it will not involve skills not yet attained by the pupil.
4. That the project, when completed, will be useful, have good design, and have good construction.
5. That the project be of such a nature that it will leave a residue of technical skill, defined by Selvidge as a 'thoroughly established habit of doing things in a most economical way.'
6. That the project be selected by the pupil of his own volition or through the psychological guidance of the teacher."

Twenty Years Ago

In the June, 1939, issue, F. C. Finsterbach, discussing the topic "Educational Content in Industrial Arts Projects" decried what he believed to be an overemphasis on making things. He pointed out that we have dignified such an insignificant item as the match scratcher with the name "project." He felt that the making of such things was, all too often, the end and all of many shop classes. He raised this issue "have teachers then become so entranced by the practical activity side of our work that the *how* has overshadowed the *why* and *wherefore?* Some teachers even boast that they 'never bother with related work because' they say, 'it is not pleasing to the boy, detracts from his interest, and interferes with his practical work.'"

"Such statements are confessions of lack of training, or a misconception of the purpose of industrial arts or a subscription to the sugar-coated variety of educational philosophy which is sending so many of its graduates to the *higher* educational courses in reform schools and penal institutions."

Ten Years Ago

From 1949 to 1951 we find few professional articles dealing with the project. The number of project ideas appearing in the magazine continues to increase. There has been, apparently, a general acceptance of the project in shop classes. Writing in the October, 1950 issue, W. Carlisle Anderson discusses the matter of getting the class in woodworking started. A major need, of course, is the matter of "what to make." He suggests that there be a *basic* project with which to start the class. The basis for choosing the beginning project, according to Anderson, should include these factors:

"1. The project must contain desirable units of instruction as shown by the project check sheet.

This includes information units as well as manipulative units.

2. Project should be useful and desirable.

3. Difficulty of construction of the project should be suited to the class ability."

The Project in 1960

This issue of our magazine focuses attention on the project and its place in industrial education today. It remains to be seen whether the project of the 1960's is to continue to be primarily wood and metal novelties and furniture. Or whether the project is to be viewed in its broader context: as any coordinated educational experience that revolves around a central idea or theme regardless of whether any take-home item is involved. ◀

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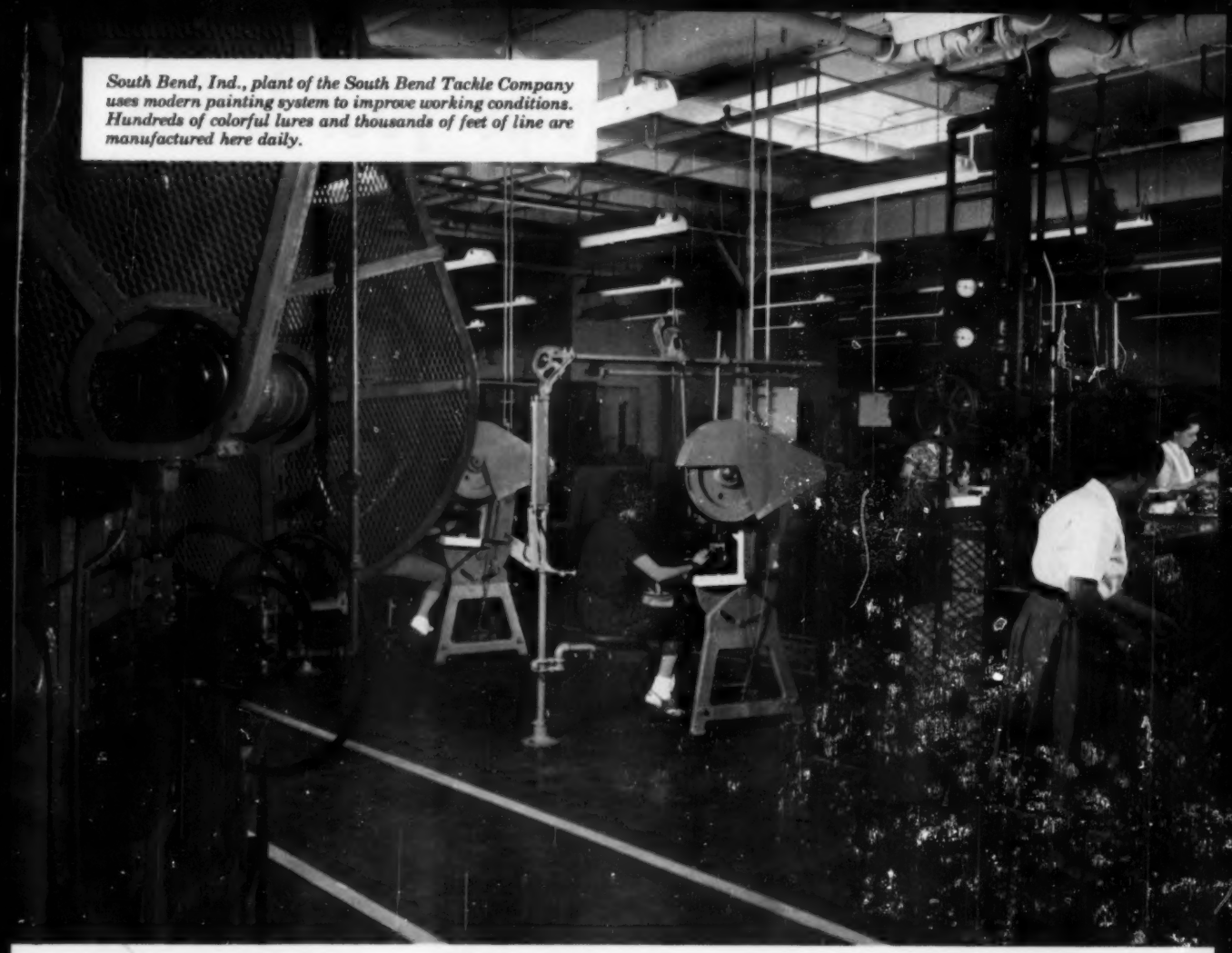

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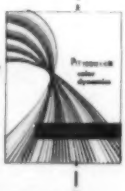

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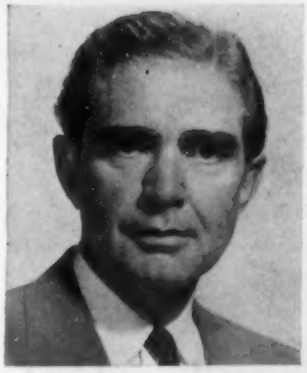

the editor's stand

OUR PLATFORM

Have you read the platform of the political party of your choice? When you vote for a personality for president, you also vote for the party platform. No political party would attempt to convince the voters to select its candidate without a clear-cut statement of its program. The big issues that all America must decide in this election year are outlined in the planks of party platforms. The platform outlines what the party is going to do, where it is going, and what it is working for. It is a concrete set of goals that the successful candidate hopes to achieve during his term of office.

What is the platform for industrial education? What are the goals we are attempting to achieve? Can we state the big issues clearly? Have we outlined our program for achieving these goals in public education?

It is our belief that industrial education does not have a platform. Further it is our belief that one is greatly needed. We believe that it should have planks that include specific, realistic objectives toward which we can strive. Of course, our platform may change with the years. Our 1970 platform probably won't be the same as the one we promote this year. It is our contention, however, that we need that platform right now.

Some of the planks we would like to suggest are as follows:

1. Courses That every boy be assured of the privilege and opportunity of at least one year of industrial arts during his seventh, eighth, or ninth grade in school. This minimum one-year course should include a survey of the areas of drafting and design, metalworking, woodworking, electricity, and power mechanics. Whenever possible, two or even three years of industrial arts should be offered to students during the junior high school years. There should be an opportunity for every boy, regardless of his vocational objective, to elect from one to three years of industrial education during the ninth through the twelfth grade of school.

2. Areas That six basic shops be promoted in senior high schools with enrollments of 1500 or more — including metalworking, graphic arts, electricity-electronics, drafting, woodworking, and power-auto mechanics.

3. Teacher Education That teaching standards in industrial education be improved so that no individual without a degree and with less than 40 semester hours of technical education is allowed to teach. At least one half of the 40-hour minimum should be in broad survey courses in the areas of metals, graphic arts, electricity-electronics, drafting, woodworking, and power mechanics. The other half of the technical courses should provide depth and quality preparation in one or more areas. No college or university should be allowed to offer a degree in industrial education unless these minimum standards are provided.

4. Team Teaching That the team approach in industrial education be supported so that, whenever possible, there are specialized teachers in the areas of metalworking, drafting, etc. This should be an organized team with a co-ordinator who will make sure that the work in all areas is integrated.

5. Facilities That adequate facilities be established, including benches, cabinets, machines and tools, for a complete shop; this installation to be done under the direction of qualified specialists. Total facilities, complete and intact, should be available to the teacher before classes start.

6. Instructional Material That every student have a basic textbook, workbook, and supplies necessary for a complete experience in industrial education. Adequate instructional material including the necessary lesson plans, visual aids, and other learning devices should be available to every teacher.

7. New Approaches That new approaches to curriculum organization in industrial education be supported. Any reorganization, however, should be done only after adequate research has provided sound, scientific evidence that the new organization is superior to the existing one. Until such time as these facts are available, we continue to support the present organization of industrial education in which the shop and courses are organized around the basic materials and finished products of industry.

8. Professional Organizations That our organizations be overhauled so that *all* industrial education teachers belong to one strong, sound, aggressive organization that can act as spokesman and lobbyist for our interests in school and political matters.

9. Educational Assistance to Foreign Countries That we promote aid and assistance to other countries to improve their programs in industrial education. However, all new programs should be cleared with a central advisory group that will co-ordinate the several programs in the same country in order to prevent unnecessary duplication, waste and the unrealistic approach.

A political platform is hammered out by a representative group of political leaders from all parts of the country. Many of the planks included are the result of compromises and concessions. No one person could hope to prepare a platform for industrial education. In a political organization, once the platform is completed, all good members support that platform even though they personally may not agree with every part of it.

We recommend that a representative group of professional people in industrial education get together to hammer out a platform that all of us can and will support. ◀

John L. Feirer

The Future Role of the Project

- Has the perpetuation of **mediocre projects in the average shop** become a major pitfall of the development of good industrial arts programs for the space-age curriculum of our high schools?
- Many industrial educators believe so and are considering **what should be done to the project** to improve its status.
- Here is a **symposium of ideas on the future of the project in industrial arts** published as a guide toward a rethinking of the content and scope of the project.

Glazener:

a material object of student learning and development

What is a "project" in industrial arts? Possibly it is agreeable to assume that it is a means to an end: a vehicle used to motivate interest, satisfaction, accomplishment, and learning; a means of achieving established objectives both common with and somewhat different from other areas of education.

When the so-called mediocre project appears to become the end product desired, it is obvious why its place in industrial arts is being challenged in recent years. The criticism is from the misuse and is justifiable in many instances.

The project method is a practical unit of learning and work which may involve manipulative activities, research, problem solving, or other activities by the student under the direction of the teacher. If this is true, there isn't anything wrong with an excellent project under the direction of a skillful teacher. The project has served our purposes in the past and will probably continue to serve our needs in the future. It appears that no de-emphasis is necessary, but rather the correct utilization and proper re-emphasis for present-day implications.

Practically all facets of education possess numerous elements of learning to develop projects as successful experiences toward an end. Writers develop poems and other projects; the musician develops the score and lyrics of a song; a pharmacist compounds chemicals to help promote health; the historian and anthropologist delve into artifacts of the past. Let us cease giving unnecessary "lip service" in bemoaning our conditions, facilities, and other "gripes," and begin taking positive action in industrial arts toward using the project as it should be — as a material object of student learning and development. When we remove the project from industrial arts, we lose the backbone of the area, the very method which other areas are now emphasizing. Its effectiveness depends on the use we make of it.

What is the future prediction for the project in industrial arts? This writer predicts the following:

1. The project is here to stay in industrial arts; not de-emphasis or elimination, but re-emphasis and change.
2. More group endeavors related to industrial production techniques either preceding or following individual application of learning involved.
3. More experimental and research techniques.
4. More co-ordination and co-operation between industrial arts and especially other experimental areas using the project method.
5. A greater application of the principles of math, science, personal relations, imagination, testing, and experimentation.
6. Improvement in design and more instruction in design principles.
7. A decreasing supply of tie racks, bird houses, and milking stools. ◀

Hostetler:

selected to achieve the objective of industrial arts

The industrial arts project undoubtedly is here to stay! But how it is used and the form it will take may determine the nature of industrial arts in the future. Even more important, it may determine whether or not industrial arts will survive in many public schools. Common salt, if used correctly, may produce a beautiful glaze on ceramic products, but if used incorrectly, it may not only destroy the usefulness of ceramic products but also the kiln in which it was fired as well.

So it is with the industrial arts project. If the project is used correctly, it has no peer as a method of achieving the goals of industrial arts; but if used as it is by so many industrial arts teachers today, it be-

in Industrial Arts

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Gorham, Maine

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Head, Industrial Arts Department
Iowa State Teachers College
Cedar Falls

WELCOME E. WRIGHT
Head, Industrial Education Department
East Texas State College
Commerce

comes mere busy work. Other teachers use it to teach the "know and do units"; still others use it to teach excellence in craftsmanship. All of these uses are worthy and justifiable when they contribute to the over-all objectives of industrial arts. However, when they are used as goals or ends in themselves, their worthiness becomes thin and their value questionable.

The project, according to the *Dictionary of Education*,[1] is: "A significant, practical unit of activity having educational value and aimed at one or more definite goals of understanding; involves investigation and the use and manipulation of physical materials; planned and carried to solution of problems and, frequently, completion by the pupils and teacher in a natural, 'real life' manner."

An industrial arts project may seem to be "a significant, practical unit of activity," but it may not necessarily have "educational value" nor is it necessarily "aimed at one or more definite goals of understanding." A project can be justified only in terms of the over-all objectives of industrial arts. A student may produce a prize winning project which has little or no educational value. The teacher may assign projects which he has carefully selected in order to provide the so-called "know and do units" he wishes to teach and yet the project may not provide any understanding of industry and its place in our culture. The real test of a good project is when it "involves investigation and solution of problems" on the part of the student. When such a project is "planned and carried to completion by the pupils and teacher in a natural, 'real life' manner," it becomes purposeful and meaningful, so it is no longer busy work.

Every project should start with a problem and may or may not end with a finished product. It may be an experimentation involving the use and manipulation of physical materials. It may be an individual or group project. The group project may be carried to completion by the line production method. In fact, it is hard to see how industrial arts can achieve its basic function today without the use of line production methods. Whatever the nature of the project, the student should have an important part in its planning and designing, in determining needs and requirements, in making models and drawings, and in selecting materials and finishes. With the help of the teacher, he should select the production method which will most efficiently produce the necessary parts of the design solution. He should design the jigs and fixtures and build them in order to implement and aid in the production. Industrial practices and processes should be used whenever possible. He should be made conscious of ways of improving the activities involved in production as well as personal evaluation in terms of things learned.

The project in industrial arts is a means to an end — it is a method, a practical way of achieving goals. It should involve the student in planning, designing, problem-solving, production and evaluation. In most cases, there is a finished product which should be well designed and well finished representing good workmanship, but a project may involve experimentations with no finished product. There should be group projects using line production methods,

[1]Good, Carter V., Editor, *Dictionary of Education* (New York, McGraw-Hill Book Co., 1959), p. 421.

"A project can be justified only in terms of the over-all objectives of industrial arts"

— Harry Goldstein

along with individual projects. Whatever the nature of the project, it must be selected for the purpose of achieving the objectives of industrial arts, and it must be meaningful and purposeful to the student in order that these purposes may be achieved.

Mitchell:

project content and method must reflect our ever-changing technology

The term "project" in education means all things to all people — a problem-research-operation-job-activity and so on, *ad infinitum*. Similarly, it serves a multitude of purposes, depending upon the instructor, the administrator, the parent, the boy, or what have you. It's the panacea of an "ailing" industrial arts program; it's the prayer and hope of the new teacher; it's the heart of a school exhibit or fair; it's what "Johnny made"; it's the reason behind taking shop; and of course, it's what can be wrong with industrial arts. It should be apparent then, that what follows is an interpretation of what the writer feels is the future role of the project.

It seems all too redundant to say that the future role of the project will depend not so much on what is written here, but rather on the interpretation, the understanding, or the philosophy of industrial arts which the reader holds. If one clings to the belief that the "take home" project or the project to exhibit at a fair or in competition is a major purpose of the program and the criterion by which the success of the teacher is judged, then the true value of industrial arts is questionable. On the other hand, if one attempts seriously to interpret the functions of industrial arts in the latter half of the 20th century, the project takes on a new meaning and relevance.

Industrial arts, as no other area in the curriculum, has a unique opportunity of providing all youth those experiences by which they may gain a better insight into our industrial technology. To fulfill this mission satisfactorily, the content and method should be reflective and interpretive of the technology. This implies, naturally, that the instructor should be aware of the common components which comprise some of our major industries. These, together with his knowledge of pupils, their interests, needs, and how they learn, provide the foundation upon which the curriculum can be developed.

It is at this point that a divergence of opinion becomes evident. How one evolves a course that will meet the requirements of industrial arts of today and of tomorrow becomes a critical issue. It is here, too, that the "battle line" is drawn — on one hand, the proponents of the trade analysis technique, the "operationists" and the "informationists," the "project methodologists"; and on the other, the "behavioral scientists," the "experimentalists," and the "unitary methodologists." It is conceivable that the proponents of each method can justify theirs as best. Be that as it may, the question which each must answer is, "To what extent does the content and method used reflect the *ever-changing technology*, and at the same time give each pupil the opportunity to 'discover' himself?"

This writer is firmly convinced that the unitary approach provides the more effective answer to this question, particularly in the comprehensive general shop. The central theme, which has its context from the technology, forms a nucleus around which all the activities and learning experiences are evolved. As in industry, the elements of design, engineering, research and experimentation on materials and methods, fabrication, construction, inspection, product control, pricing, distribution, and others are not only studied but the products, projects or activities which typify the industry are carried on or produced and evaluated. The problems of social interaction, of labor, and of management are considered as they relate to the on-going activities and the unit theme. Again, as in industry, not all pupils are capable of conducting experiments, or designing jigs or fixtures, nor do those who can accomplish these always possess the mental attitude or physical capacity to perform some of the manipulative tasks at which others may be more adept. The unitary method has a

(Continued on page 60)

The Group Project As a Beginning I-A Experience

TALMAGE B. YOUNG

- **Needed: a shift in i-a emphases from instruction of job shop and hand craftsmen processes to an orientation of youth to modern technology.**
- **Here is an approach to remedy this difference in theory and practice by introducing the subject with group project activities.**

Perhaps the greatest need in industrial arts education is a shift in emphases which will enable the student, the teacher, and the general public to understand the basic function with which the area is concerned. Traditional emphases are upon materials and obsolete processes rather than upon "industry, its organization, materials, occupations, processes and products — and with the problems resulting from the industrial and technological nature of society." Under this circumstance, it is impossible for those who observe our work to see the logic in what we do. We profess to orient youth to modern technology but our practices are those of the job shop and hand craftsman.

The following deficiencies noted concern the traditional teaching method:

1. Too much emphasis is placed upon the product as the end of the educational process.
2. Too much time is spent in hand woodworking in relation to its importance in understanding industrial processes.
3. Directly related, technical information is often unrelated to the project.
4. Learning procedure is often fragmented or out of logical order.
5. The course activities do not meet the total definition of industrial arts.
6. The course activities do not provide for the realization of many of the accepted objectives of industrial arts.

Several factors were considered as basic guides in attempting to establish an approach which would overcome the deficiencies stated above. The following is a summary:

1. A greater emphasis should be placed upon the problem-solving approach.
2. A greater emphasis should be placed upon understanding woodworking in terms of modern industrial practice.
3. The importance of planning in industry should be emphasized by active teaching and example rather than by words and rote requirement of plan sheets.
4. "Personnel organization" should be real rather than "make believe" and should have a real purpose in the process.
5. A higher standard of quality and workmanship is desired in beginning products.
6. Greater attention must be given to teaching design early in the student's experience.
7. The importance of work organization and efficiency in industrial production should receive attention.
8. The teaching process should be organized around a set of common problems in order to achieve better motivation for the group.
9. The teaching process should involve the total group in the total process in order to develop a better understanding of democratic action through group process.
10. The above emphases should be integrated so that a better development of meaning is secured.
11. Information should be taught in terms of function rather than in terms of abstraction and, in so far as possible, for immediate use.
12. All demonstrations should have pertinency to the productive problem.

Dr. Young is associate professor of industrial arts education, North Carolina State College, Raleigh.

A New Approach

Based upon these guides, an experimental approach has been used in teaching industrial arts woodwork to beginning college freshmen which can be adapted at both the junior and senior high school levels.

Several attempts to strengthen the existing woodworking courses through the use of "mass production" projects were disappointing. In attempting to evaluate the results, it seemed that too much time was spent and that this type of activity was often confusing to the student. Both the confusion and the inefficiency seemed to originate from the conditioning of the students to the student-planned, student-constructed project which had been used initially with these classes. It seemed that the original hypothesis that individual experience with a project is necessary before attempting a "mass production" project was in error in that the experience became a liability rather than an asset in working with a group to manufacture a product. The solution seemed to be to try reversing the process by using the "group project" first, thereby avoiding preconditioning. The following description is an outline of the types of activities used and is not intended to provide details. It is assumed that at different levels and with different subject-matter areas, the details will vary.

Since it is not possible to duplicate in detail all of the procedures used in line production, it seems best to utilize as many as possible of the principles used in line production but

to alter the process if necessary to secure maximum educational values. In order to avoid confusion with the terms "mass production" or "line production," the term "group project" is used to describe the activities associated with this teaching unit.

Project Selection

Like any project, the article chosen is not the end of the activity but is used as a focus for the activities in a series of organized learning experiences. In selecting the article, the learning experiences should receive primary consideration by the class. Students should be given some of the characteristics of a desirable product in terms of size, cost, and the processes needed to provide a good learning situation. Each student should be asked to present an idea with a drawing, a picture, or a model so that others of the group may examine the idea. By elimination, the field may be narrowed to three projects which may then be discussed in detail.

Considerable guidance will usually be required in selecting the project since beginning students do not know what can be made in the shop and do not understand the educational requirements which the project must meet. The teacher must point out the advantages and disadvantages of each suggestion and provide other types of information before the class is allowed to decide upon the article to be constructed. It is assumed that, in general, the lower the educational level of the group the greater will be the responsibility of the teacher. It is possible that in some instances that better educational efficiency may result if the teacher selects the project. In this event, the process would start with the planning stage.

Planning

The article selected should be at the ideational stage and should not be a dimensioned or full-scale plan since many of the problem-solving activities are to be found in developing the design. Each step in planning must be entered into by the whole class if it is to be meaningful to each member. At this stage a degree of groupness should have been developed through the discussion which has taken place concerning the selection of the product and interest will have been generated sufficient to motivate the average student. The teacher should serve as a guide and consultant throughout the planning procedure. It is very desirable to have the students participate in the entire planning process and considerable use should be made of discussion by the group and of decision by vote or consensus.

Selection of materials provides the teacher with an opportunity to discuss the different characteristics of materials, finish, and hardware in relation to the problem under discussion. The working characteristics, cost, finishing characteristics, availability, etc., as well as the general qualities of woods as a production material should be discussed.

Design details should be worked out with the group. The teacher must spend considerable time in explaining the principles of good design and in guiding the students in designing an attractive and functional article. Line, proportion, harmony, and other aspects of visual design should be settled in relation to function before structural features such as joints and fastenings are studied. It is also necessary to develop a sense of economy in structure as it relates to production and to teach the proper methods of computing and noting sizes, etc. After these preliminaries have been completed, the teacher and the students continue planning, paying particular attention to structural details.

Structural considerations and manufacturing considerations of design should be tested in the shop. Demonstration is the principal teaching device for this stage. The teacher provides a series of demonstrations for the entire class which involves constructing the model. Each operation is carefully explained and performed for the group. The student is introduced through this means to stops, jigs, and fixtures as used in industrial processes with emphasis upon the fact that these are the devices which enable modern industry to produce complicated articles using primarily semi-skilled labor.

As each operation is performed, the teacher should call attention to the proper and safe way to perform the operation and should emphasize the general operational characteristics

how the group project can introduce

of the machine. It is at this point that safety consciousness should be developed and an attitude should be established that will guide the student in his relationships with dangerous machines. Attitudes are developed through understanding; therefore, the teacher should spend considerable time in explaining and demonstrating why certain operations are inherently dangerous and explaining how these dangers can be minimized through careful and thoughtful planning of the operations to be performed.

If the project has been chosen wisely, the students will have a fair, general knowledge of the entire process involved in the production of the project by the time the instructor has completed the model. At this stage the student should have an opportunity to suggest ways in which the model can be improved and to make suggestions concerning changes in size, shape, or structure. Bills of material, job tickets with detailed procedures, and typical routing should be discussed and planned with the group.

Production

It is necesary to organize the group to carry on the production of the project. The organization should not be more complex than necessary to carry on the function of producing the project. It is necessary to have a group responsible for central planning and one to assume the responsibility for finance. The teacher must act as general superintendent and a student should work as general foreman. Small groups should produce individual parts since this gives each group a complete set of experiences connected with the production of the article and places responsibility. The group must be made aware that the proper sequence of getting out stock for parts is as important as the procedure for producing the parts. They should also understand that the margin for error is very small and that every part must be checked and rechecked with the master drawing if a satisfactory product is to be obtained. Priority is established by the group involved in the central

planning for the production of each part. This group may also take part in the production of certain parts if they are needed as operators. Each group makes all fixtures or jigs needed in the production of the part assigned to it in consultation with the central planning group and with the teacher. Under this plan it is felt that the learning process is more nearly complete and that each student will be involved in some of the planning as well as productive processes.

When all of the parts have been machined, they may be divided out to each member for assembly and for finishing. It will be noted that this is an operation which may require hand skills or it may be found that jigs and fixtures will be necessary to assemble the project. In either case the student may learn several principles with which he would not become acquainted if the assembly line approach were used. The necessity for care in using glue sparingly in assembly, the technique of squaring, etc., will not be the experience of each student if one or two do all of the assembly. Hand sanding and minor repairs are best taught as a part of the experience which the student has with the product he will receive as his own and upon which he will be graded. It is also desirable that each student have firsthand experience in filling, staining, sealing, and finishing his project.

The mass production procedure should be explained to the students relative to assembly and finish if the project is to be assembled and finished by each student. If the project is small, it may be assembled and finished as a group activity. The prime consideration for determining procedure is educational rather than economic. It is felt that individual sanding, assembly, and finishing will give each student a sense of personal accomplishment and give the teacher a basis for making some judgments concerning the potential skill of the student.

Evaluation has two discrete parts. One is the evaluation of the entire procedure by the students in which they review the operation and attempt to assess their mistakes and their successes in terms of the product and as a learning situation. The second phase is an evaluation by the instructor and the student of the participation of the student and of the quality of workmanship demonstrated in assembly, clean-up, and finishing of the product. It should be noted that with few exceptions that the teacher is able to judge the student as well on the work he has performed in assembling and finishing the project as he would if the student had made the product from the beginning. Peer-group rating systems have also been found valuable in assessing the effectiveness of each individual as a member of the group. Evaluation of understanding may be judged through proper testing or through written reports in which leading topics or questions are used to secure a uniformity of departure for written discussions.

Advantages

It is felt that the following advantages are inherent in this approach:

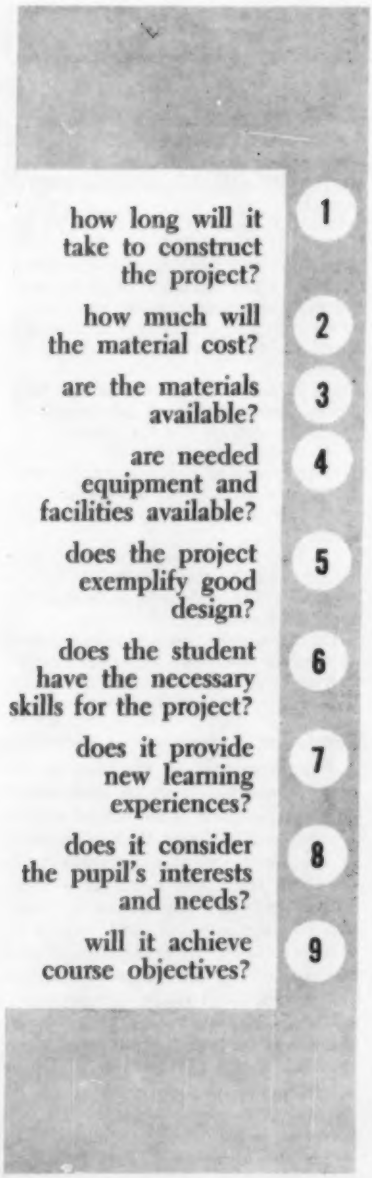
1. It lends itself to an organized approach to teaching in that it concerns the entire group with a common problem. This is necessary for economy of teaching effort.
2. It enables the teacher to deal comprehensively with the planning process using a concrete subject and a complete activity.
3. It enables the teacher to deal realistically with a design problem so that an approach can be demonstrated for the future guidance of the student.
4. It provides a basis for giving relevant and meaningful demonstrations for immediate use.
5. It provides for repetitive operations using stops, jigs, fixtures, etc., necesary for an understanding of the techniques used in industrial manufacturing processes.
6. It demonstrates the necessity for maintaining constant control and accuracy in process.
7. It is conducive to the development of an understanding of democracy and group process.
8. It establishes a high standard of design and workmanship for future work by individual members of the class.
9. It enables the teacher to test and evaluate student performance and understanding upon a fairer basis since all students have had equal opportunity to observe and participate in the production of a common project.
10. It provides a basis for practice in critical judgment since the student is not as closely associated with the finished product as he would be with an individually selected and constructed project.
11. It provides an opportunity for all students to participate at a level commensurate with their ability. The more advanced students should be in the central planning group and the less experienced will find satisfaction in machine operation, etc. It gives all a chance to succeed.
12. It does not force students into project planning without the experience which is necessary for planning.
13. It gives the teacher better control over the teaching situation and enables him to handle a larger group than can be comprehensively handled on the individual basis.
14. It provides a real concrete teaching situation in which means are consonant with the ends and in which the approach is direct.
15. It provides for an understanding of machine operation in terms of total process rather than in terms of a disjointed series of demonstrations.

Conclusion

This approach to teaching beginning woodwork seems to meet many of the objectives of industrial arts in a more realistic way than is possible in the more traditional approach. It does not meet the need for a completely personal experience in problem solving, however, and should be followed by a student-planned and student-constructed project in which the student will apply the problem-solving techniques demonstrated in the group project. It should be noted that this places the learning activities in the proper sequence and that the student planning and production will progress much more efficiently than is possible under a system in which the individual project is attempted first. ◀

Nine Criteria For Project Selection

ARTHUR O. BERRY



- Projects, the vehicle through which students learn about our industrial and technological world and develop basic skills, are **the core of industrial arts instruction** today.
- To improve the value of this vehicle, here are **nine questions on project selection** as one key to closer achievement of our objectives.

If we examined all forms of industrial arts teaching being practiced today, we would find the project is still used as the core of every program. The project serves as a vehicle through which boys and girls learn about the industrial and technological world in which they live. It is a means to better understanding and appreciation of our culture, as well as a means for developing some basic skills in one or more of the several industrial activities. Consequently, the selection of the projects to achieve these ends or goals is of paramount importance to us.

Do you assign projects where you base their selection on operations and tool manipulations, or on learning experiences that you feel the pupils should experience from your course? Do you determine what the pupils should learn? Do you use guided choice method where pupils are given an opportunity to select one of two or more similar projects which can be made? or do you provide for free choice of projects in your shop?

Criteria for Project Selection

Whichever method you use in the selection of projects, there are certain things which you as well as the pupil should consider before the final decision can be made. What then, are these items or criteria that we must consider? Let us examine them.

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1. Construction Time Involved

The time involved in the construction of the project must always be considered. Can the project be completed during regular class periods? Will the pupil have to spend extra time in the shop in order to complete the project? Can the project be completed before the end of the school year? Underlying this criteria is the important psychological factor of the interest span which is so evident in adolescence. The experienced teacher knows that the interest span varies with all pupils, younger ones usually having a shorter one than older ones. The unfinished projects or the discouraged pupils are the aftermath of failure to consider these factors. Many of us have learned by experience that three or four small projects which can be completed in a short length of time will maintain interest at a higher level than one large time-consuming project. It's not uncommon, however, when boys are given free choice of projects that they will select larger ones, but it is the wise teacher who can guide them into projects that are within course time limits and interest span.

2. The Cost

This criteria is considered by all in project selection. While many schools supply all materials the pupils use, others require the pupils to pay for some, or all, materials. In this day of the deflated dollar, we are continually faced with the problem of cost. If all materials are supplied, smaller projects involving economical use of the materials are selected. On the other hand, if the pupils pay for the materials they are using, the projects selected may be limited only by the pupils' pocketbooks or what they can afford. In either case, it is our responsibility, as teachers, to consider project costs in the interest of consumer economics. Eventually, all pupils will become home owners and consumers of the materials and products of industry. They will become aware of quality materials and goods. They will live on limited incomes and will have to learn how to spend their money wisely. Our pupils will become good consumers if we stress costs and their affect on project selection.

3. The Materials Available

Are the materials available in the shop for the project I would like to make? If not, can they be obtained locally or will I have to send away for them? I'm reminded of a boy constructing a card table. The plans called for Stanley card table braces. The boy worked very hard on his table and his workmanship was excellent. When he started to assemble the table, he found that the braces were not available in the shop. The instructor sent him to the local hardware store, only to find that they didn't have them either. The instructor had to send to New Britain for them, but in the meantime, the student lost his interest and enthusiasm for the card table as well as the work. How many times has this happened in your shop? It need never have, if thought was given to this criteria.

4. Equipment and Facilities

Another criteria which is often neglected in the selection of projects is the availability of equipment and facilities. Many school shops have limited equipment, tools, work areas, and storage facilities. Failure to consider this criteria can create many problems for us. In one shop I visited recently, the writer saw a 12 ft. row boat being constructed by one boy. He was using all the assembly space available in the shop and the rest of the class was cramped around a few benches. In another shop, he found two automobiles squeezed into space adequate for one. If for no other reason than safety, we must consider this criterion. The principal factor accounting for the prevention of accidents is the human element. Most accidents are the result of someone's thoughtlessness, carelessness, or lack of consideration of the other fellow. Most accidents can be avoided if we develop in our students the habit of thinking before doing. Safety as applied to procedures in the school shop resolves into one's using common sense and good judgment.

Are you using good judgment and common sense in the use of facilities and equipment available in your shop? How many of you have had pupils constructing projects only to find a tool or piece of equipment needed for the next operation was not available? What did you do? Did you devise another method to perform this operation? Did you obtain this tool from a local industry? Did you send the project down to the local industry and have them perform this operation, or did you leave the project unfinished? In any case, if the availability of tools and equipment was considered in selecting the project, this problem would not have been created. It is important that we consider our equipment and facilities when selecting projects.

5. Design of the Project

Any project that is constructed in the school shop should exemplify good design. It should be stressed in every project that is selected. Consider the principles of balance, proportion, harmony, symmetry, and functionalism; are they evident in your pupils' projects? Will the project serve the purposes for which it was intended? Are the materials to be used suitable to the design and function of the article? These are questions that must be answered when selecting a project. The writer recalls a candy dish a boy had made which had an attractive pierced design. In the shop it was beautiful, but when the boy took it home, he discovered, to his dismay, that the small candies and nuts passed through the design. Another incident showing the lack of functional design was an ash tray that tipped everytime a cigarette was placed in it. How many of you are guilty of approving projects that show lack of an appreciation or understanding of the simple elements of design?

6. Ability of the Pupil

If the needs of our pupils are to be met, we must consider the pupils' ability. The needs of a boy with an IQ of 68 are not the same as those of a boy with an IQ of 110. Every precaution should be taken to guard against failure or disappointment. Many pupils are inclined to underestimate the difficulties involved in projects requiring a relative high degree of skill and tend to overestimate their abilities. Projects that require too high a degree of skill should be avoided. Why not simplify the project idea until it is within the ability of the pupil? When a new pupil enters your class and you are unaware of his ability suggest that he demonstrate his ability on an easier project before starting a more difficult one. How many of us have had the experience of having a student come into the shop for the first time? He is full of enthusiasm with a desire to make a desk or some large object. Because we don't want to kill or destroy interest, we approve only to find the project left in our shop at the end of the school year or being completed by us in our spare time. We failed to consider the ability of the pupil or the high degree of skill and accuracy required to construct the project. Think over your years of experience as a shop teacher. Can you recall a case of a project being above the ability of the pupil? Pupils vary in ability. We must check records, give mechanical aptitude tests, observe pupils as they work, or devise some means of determining their abilities.

7. New Learning Experiences

How many times have your pupils asked to make three or four of the same article or project? I think it has happened to all of us. Many pupils are content to work in areas or activities in which they know they will find success. They must be motivated to explore or learn something new. We, as teachers, must assist our pupils to the degree that they include new learning experiences in all projects. The field of industry is so broad

(Continued on page 66)

DESIGN for the TEACHER

john r. lindbeck
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▶ the sixth in a series of articles which began in your IA/VE for January, on how to apply the principles of good design to I-A instructional areas —

Woodworking Project Design

Much has been written and much said about the significance of analytical methods in designing. The quest for answers to the many questions which arise in design activities can be viewed as a means of providing a firm, logical, basis from which to begin. Designing can be made simpler and more interesting by employing this analytical approach.

Typical questions to be answered regarding design tasks are: What is it for? Where will it be used? What factors will control the dimensions of the project? Are there any special limitations with respect to materials or processes or tools?

An example of the technique above, as applied to woodworking projects, can be seen in the matter of designing the component parts of desk sets. This activity can be undertaken by individual students or as a class project in which the group collaborates in designing the pieces. In either case, the role of the instructor is that of a guide to the students, helping them to find the answers they seek.

Three components of the desk set will be considered here: the desk pad, the correspondence tray, and the pencil holder.

The Desk Pad and the Correspondence Tray

The standard paper-card sizes most convenient for desk use will certainly have a bearing upon the dimensions of the pad. Available at any stationery shop or book store, the sizes of the cards or paper pads are: 3 by 5, 4 by 6, and 5 by 7 in. It is wise to allow an eighth of an inch or so for clearance, so that the paper won't jam in the box. Insofar as the task involves the area of woodworking, the problem of materials is pre-determined. However, if the designer wishes to match the set with the decor of an already existing room or office, he will want to select woods in keeping with this decor.

The instructor may choose to impose certain restrictions upon the class with respect to tools and machinery used. In a beginning class, he might limit the group to hand methods; more advanced classes may have complete freedom to use any tool or machine or process.

Illustrated in the exploded view is one result of this undertaking. It utilizes ⅛-in. stock for sides and bottom; the top and front are of two-ply veneer; and the back is a single-thickness of veneer. The block is included as a means of attaching a pen funnel, thereby permitting the placement of a pen convenient to the paper supply. This, of course, is optional.

Similarly, the design of the tray can be accomplished; it, too, carries certain dimensional restrictions because of standard papers. The 8½ by 11 business or 8½ by 14 legal size papers are the common letter sizes available and in use. The material comprising the tray is the same as that of the pad holder, and utilizes the ⅛-in. stock. The tray design should be in keeping with that of the desk pad so the two will appear to "belong together," as integral parts of a set.

The Pencil Holder

This interesting piece provides a safe, neat, and handy means of storing pencils. Working with a material

identical to that of the desk pad and tray, this simple container is turned on a lathe, with holes then bored into it. An alternative to this could be a square block of wood, again with the holes bored into it. Some decision will have to be made regarding the size of hole; a 5/8-in. bit will produce a hole for two pencils. If single-pencil holes are desired, the 3/8-in. bit will do nicely.

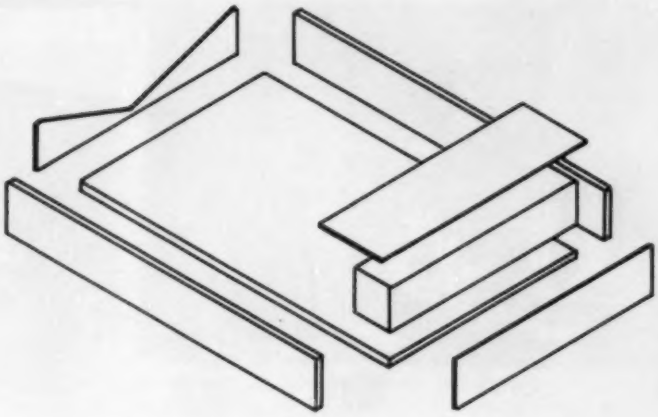
The solution presented here is adequate for it protects the hand from sharp points and conveniently stores the pencils. The top of the holder in the photograph has been painted flat black to protect the top from pencil marks. This is up to the discretion of the person making it.

Suggested finishes for the component pieces are lacquer, oil and wax, or the wipe-on finishes; the undersides can be flocked to prevent any marring of the desk tops.

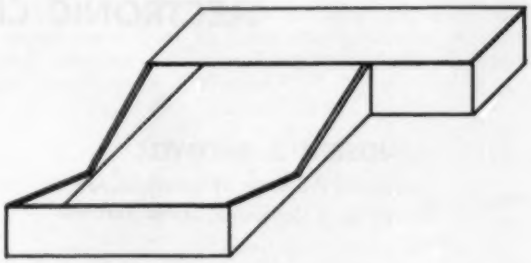
The photograph and the drawing show a few possible solutions to this design problem. Similar tasks can be approached in a like manner: a desk caddy, for holding paper clips, rubber binders, erasers, etc.; a night caddy, for holding a wallet, cuff links, pocket secretary, pen and pencil, keys, loose change, etc.; a bridge scoring pad; a kitchen memorandum pad; or a desk calendar pad.

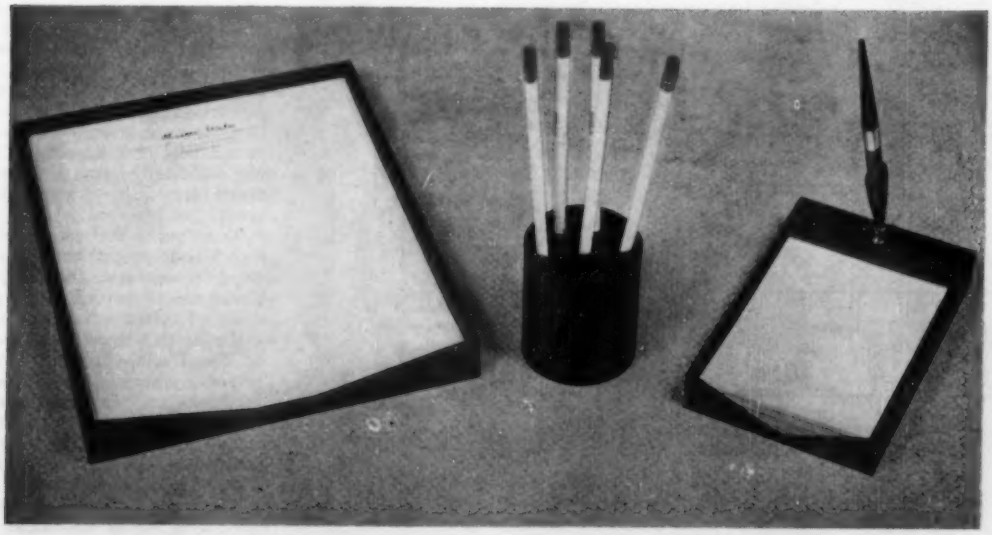
Meeting these tasks analytically and with an inventive mind can produce a number of striking, creative, and ingenious results.

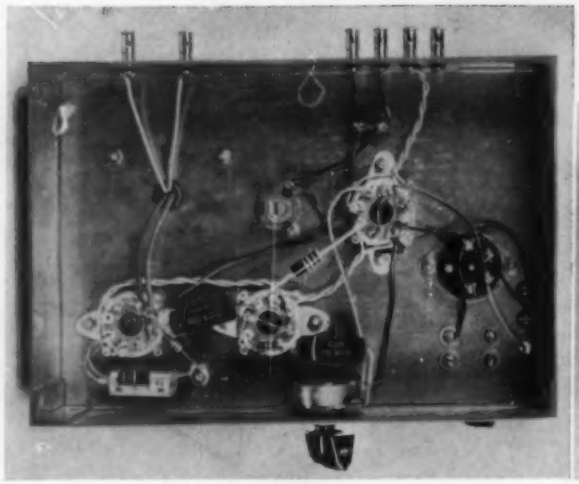
DESK PAD—
SUGGESTED DESIGN



ALTERNATE DESIGN







Top and bottom views of unit using crystal detector, voltage amplifier, power amplifier series. At lower right is shown a plug-in type grid leak detector which is directly interchangeable with either the crystal detector or the 6H6 type thermionic diode tube.

STANDARD AND PLUG-IN TYPE ELECTRONIC CIRCUITS

JOSEPH J. SAYOVITZ
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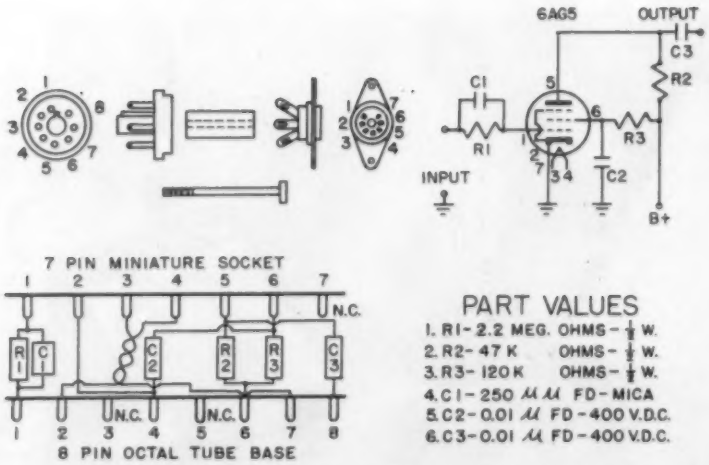


PART VALUES

1. R1 - 2.2 MEG. OHMS - ½ W.
2. R2 - 47 K OHMS - ½ W.
3. R3 - 120 K OHMS - ½ W.
4. C1 - 250 $\mu\mu$ FD - MICA
5. C2 - 0.01 μ FD - 400 V.D.C.
6. C3 - 0.01 μ FD - 400 V.D.C.

A graphical method of representing the layout and mode of construction used with a plug-in-type circuit.

Some time ago, the members of the radio and electricity club at the University of California at Santa Barbara took on the project of developing a unit which would aid them in their future teaching activities. The fundamental idea was to develop a number of basic circuits which could be wired into a chassis designed for this purpose. The entire circuit was to be flexible with provision being made for the use of single circuits as well as add-on circuits which would illustrate additional concepts. Initially, the unit entailed commonly used basic circuits such as detectors, voltage amplifiers, and power amplifiers. In each case, the wiring and number of components used was kept to a minimum as an aid to the beginner in the field of electronics. The chassis was sufficiently large in area to avoid undue crowding of leads and components.

As an aid to the teacher and student, each circuit was written up and duplicated on a separate sheet of paper. The circuit description included a schematic, a list of component parts, and a brief explanation of the purpose and function of the circuit. On a second sheet appeared a physical layout of components for that particular circuit in addition to the method by which it would receive energy from a preceding stage. Also, the design was such that operating potentials were carried from a completed stage to the next one under construction. The use of individual sheets in-

creases the flexibility of the unit, enabling the teacher to base his selection of the amount of written material to be used on his method of approach, as well as the level of the student group.

Early in the planning of the unit, it became apparent that the front end could be designed in such a manner that either a thermionic or crystal diode could be used interchangeably by unplugging one and inserting the other in its place. Further, since no components appeared at this stage, and with the addition of correct operating potentials, the design of a more complex plug-in type detector might be evolved. Since the grid leak type of circuit has the characteristic of high sensitivity, it was selected to portray the effect of amplification upon the detected signal. Plug-in type of construction would illustrate the feasibility of complete circuits which are quickly interchangeable, are being presently developed and used in industry, and can be easily constructed in the industrial arts laboratory.

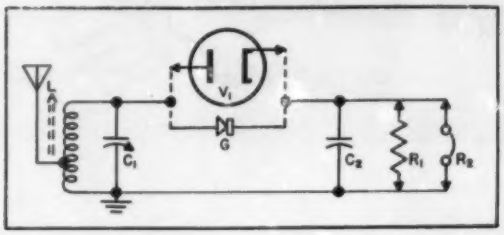
Currently, either through surplus agencies or commercial establishments, there are available miniaturized components which lend themselves well to the design and construction of small plug-in units. A flat-type diagram illustrating the connection of components to the seven pin and octal sockets was evolved by rolling out the plug-in circuit on a flat plane. The orientation of the pins on the two sockets is as indicated on the diagram.

Construction of the plug-in unit is accomplished by using the base of a metal type octal tube, drilling a hole through a three eights inch diameter bakelite rod (1 5/16 in. long), and assembling the three major parts. The individual who mounts components on the assembly should have had some wiring experience prior to attempting this task.

The unit lends itself well to the development and study of many additional types of electronic circuits, both under-the-chassis mounted and plug-in types. Where plug-in circuits are utilized, the chassis may be left permanently wired, permitting most miniature type tubes to be used with an octal socket. There are many forms of oscillators, timing, triggering and other circuits which can be readily adapted for use with the unit.

The utilization of single sheets describing various aspects of each circuit makes it possible to serve a wide level of student ability and experience. The beginner or slow learner may require complete information, whereas the advanced or more able student may be given limited information and be expected to carry on from that point. The use of this type unit tends to place responsibility upon the student and does much to relieve the teacher of minute details, permitting him to spend the greater portion of his time in overall instruction and in the evaluation of learning. There is also an excellent opportunity to utilize the more advanced student in the planning and development of additional circuitry, including measurement techniques and an analysis of expected results.

DIODE DETECTOR
Crystal and Vacuum Tube



I. Operation: Both are half-wave rectifiers; therefore when the R.F. signal on the anode swings positive, the rectifier conducts and the rectified current flows through the load resistance.

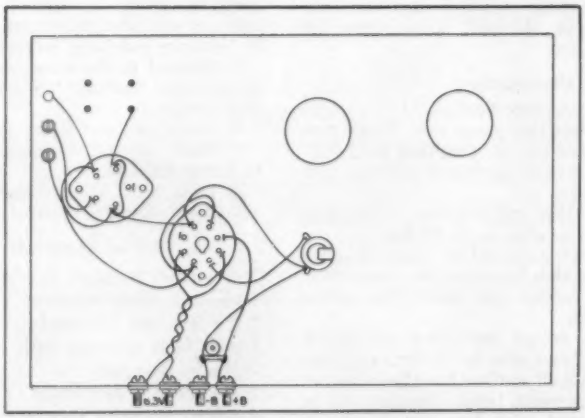
Because the D.C. output voltage of a rectifier is directly proportional to the A.C. input voltage, the D.C. across the load resistor varies in accordance with the amplitude of the R.F. carrier and thus reproduces the A.F. signal. A filter capacitor is used to smooth out the R.F. variations, but it should not be large enough to attenuate the high audio frequencies excessively.

II. Advantages: The diode method of detection has the advantage of producing less distortion because the dynamic characteristics of a diode can be made more linear than those of other detectors. There is only a very slight reverse current in the case of the crystal and none in the vacuum tube. The circuitry of the diode detector is extremely simple and inexpensive. The crystal diode requires no heater circuit; the diode tube does. The crystal is much smaller and cheaper.

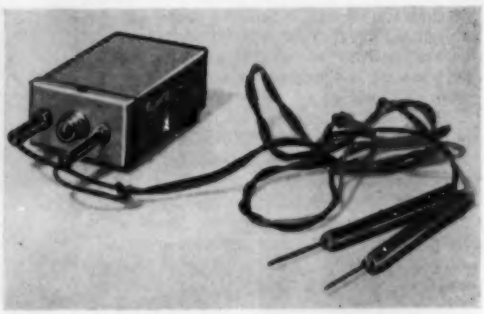
III. Disadvantages: Against the diode unit is the fact that it draws power from its input circuit, thereby reducing the overall- selectivity of the receiver. No diode is capable of any signal amplification, R.F. or A.F.

IV. Parts List:
C_1 ...365 uufd. var.
C_2 ...100 uufd. cer.
L ...Tapped Ferri-loopstick
R_1 ...500K to 1 Meg. load
R_2 ...Alternate load, 2000 ohm headset
V ...6H6 diode tube
G ...1N34A Germanium diode

Example of a typical instruction sheet including schematic, circuit description, and parts list.



Example of a physical layout to accompany the instruction sheet shown above. The wiring is oriented to accommodate a crystal, thermionic, or plug-in detector without any change.



CONTINUITY CIRCUIT TESTER

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An adequate general shop program must include some electricity. To work with even the most basic electrical circuits it is convenient to have some type of continuity tester available for checking purposes. For those who have the necessary facilities to fabricate such a tester for classwork on the elementary level, we want to pass on this idea. It is a useful and practical project for any general shop program.

The project involves the application of simple sheet metal technique. If the gauges are adhered to, the unit can be built on a simple workbench without the use of sheet metal bending machines (although, if available they will simplify the operations). The parts are readily available from standard supply outlets, or may be obtained in kit form for slightly less.

Steps in Construction

A. Top and Side Section

1. Obtain thin gauge steel, 26 ga. preferred, and lay out according to sketch.
2. Cut away unwanted portions with hand snips.
3. If sheet metal brake is available, bend ⅛ in. edge up to 90 deg.
4. Moving to end of brake to allow ⅛ in. section to be outside, insert four sections under and bend fifth section up 90 deg.
5. On dotted line move out fourth section, bend also to 90 deg. and continue until all sections have been bent to a 90 deg. angle. Some difficulty will be encountered with last two bends. It may be necessary to partially open bends two and three to get number four completed. This will do no harm, however, since it can be pushed together by hand after removal from the brake.
6. The alternate method of bending without a brake is accomplished by accurately machining a hard wood block to fit snugly into the box when bent to shape. Subtract thickness of metal from dimension of wood block when machining it to size.
7. Clamp the metal in a vise with the layout lines next to the block. A second wood or metal block on the other side of the metal will facilitate the operation.
8. While thus clamped in the vise bend and gently hammer the sections around the wood block until it fits snugly inside. Start with top section between blocks by this method, and bend side and end portions around.

B. Bottom and Back Sections

1. Proceed in the same manner with layout and bending the bottom and back sections.
2. Insert this section in place.
3. Solder around the edges and back to insure stability.
4. Drill four holes through bottom side along edges for rubber feet.

Bill of Materials

1 set of test leads, 48 in. long
1 pin jack, black, insulated
1 pin jack, red, insulated
1 pilot light assembly with jewel front $^{11}/_{16}$ in. hole size
2 No. 49 pilot light bulbs (1 for spare)
4 rubber mounting feet
4 No. 4 by ¼ pan head sheet metal screws
1 large size flashlight cell

C. Front Section

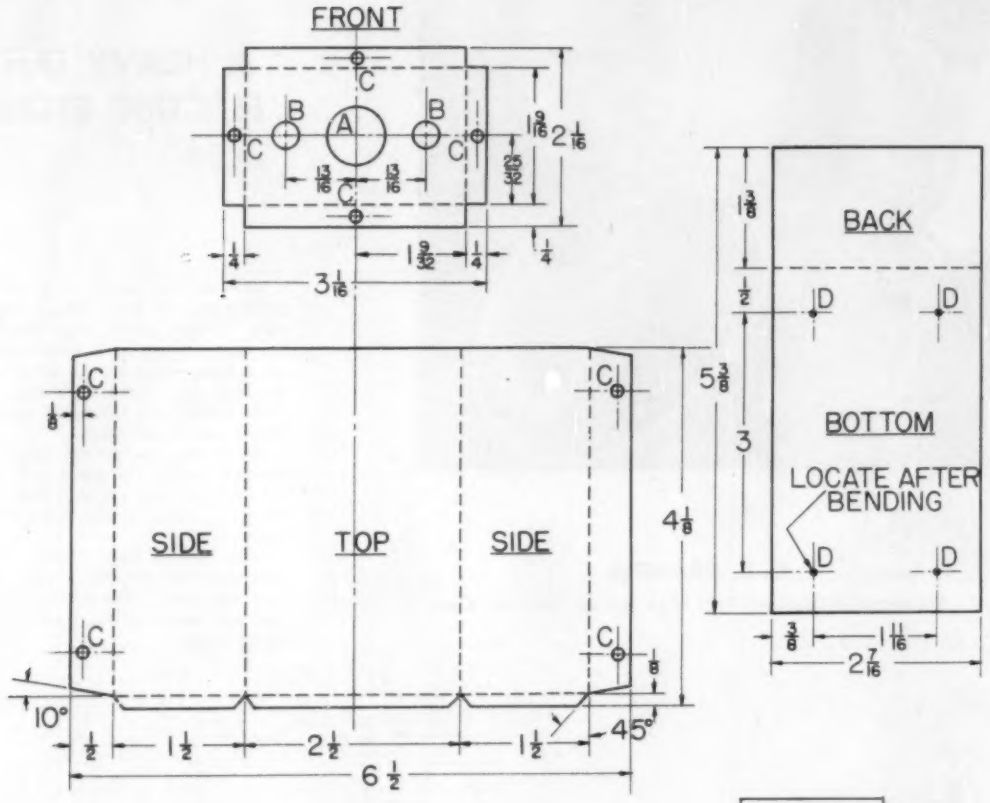
1. Obtain heavier metal, 22 or 24 ga. and lay out front section.
2. Cut away unwanted portions, and punch or drill and file holes to size.
3. Bend side sections around to fit snugly over end of case.
4. Locate and drill holes in case to match sheet metal screws.
5. Insert screws, file corners off and paint all outside and inside surfaces of metal box. Wrinkle finish paint is suggested.

D. Internal Brass Section for Battery Mount

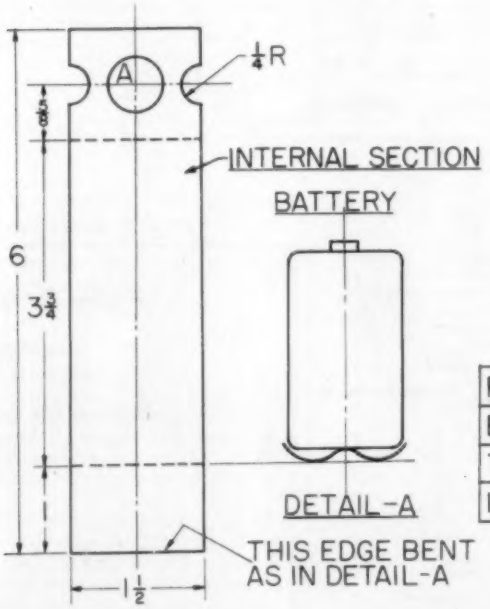
1. Obtain heavy gauge spring brass, 18 or 20 ga.
2. Lay out, cut away unwanted portions and bend to dimensions shown.
3. It will be necessary to bend the back portion at the top edge so adequate contact will be made on the bottom of the dry cell.
4. The corners should also be bent around so the dry cell cannot slip from side to side.

E. Assembly

1. Mount red pin jack on right side.
2. Mount black pin jack on left side.
3. Mount pilot light in center. The pilot mounting holds the brass section in place against the front section.
4. Solder a short wire between the terminal of the red pin jack and the shell terminal of the bulb socket. The center terminal of the bulb socket touches the positive end of the dry cell which results in a positive (red) polarity on the red pin jack. This is a polarity color used repeatedly.
5. Solder a short wire between the terminal of the black pin jack and a convenient point on the brass section.
6. Insert the bulb and battery and see that the latter has sufficient tension against it to stay in place.
7. Insert the entire assembly in the case and screw on the cover.
8. Insert the test prod pin plugs, touching the prods together should light the bulb which indicates good continuity.
9. It is desirable to have an extra bulb readily available. One may be screwed into a spiral socket made from a soft piece of No. 14 copper wire and soldered onto the brass section.

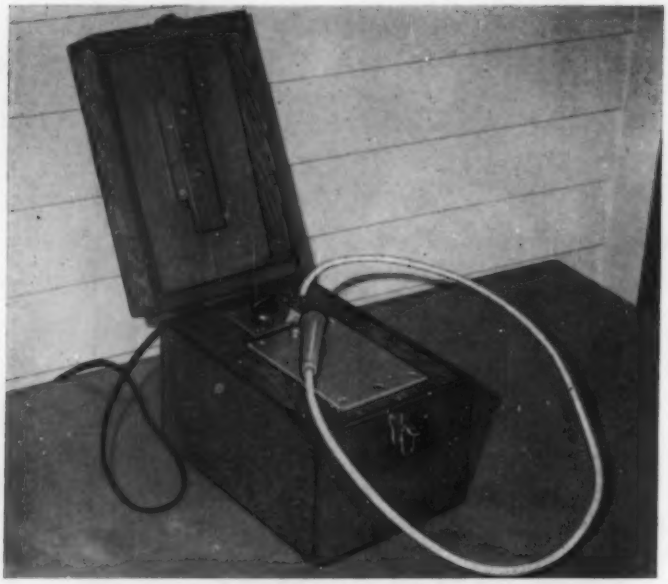


A – $\frac{11}{16}$ DIA.
B – $\frac{5}{16}$ DIA.
C – $\frac{5}{32}$ DIA.
D – $\frac{1}{16}$ DIA.



MATERIAL

FRONT	24 GA.-C.R.S.
BACK & BOTTOM	24-26 GA.-C.R.S.
TOP & SIDES	24-26 GA.-C.R.S.
INTERNAL SECTION	20 GA. BRASS



A HEAVY DUTY ELECTRIC ETCHER

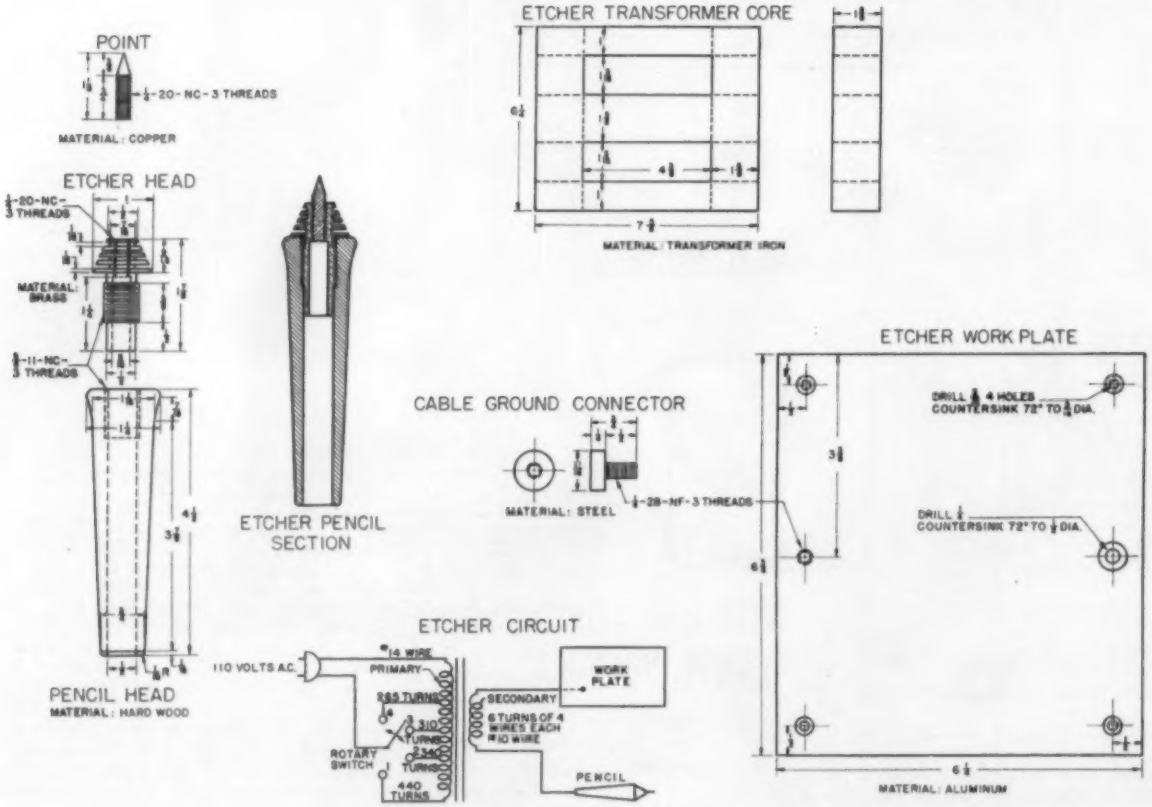
R. L. GRANDLE

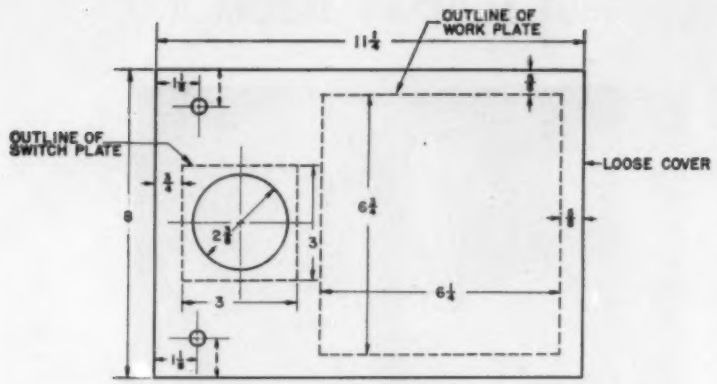
Instructor of Drafting, East High School, Wichita, Kans.

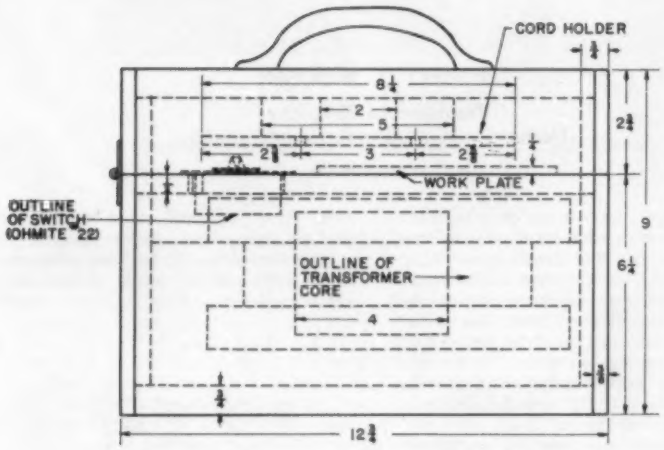
This electric etcher is a very good project for a high school electricity class. Every school shop should have one and it will be a very useful tool around any factory, auto service garage, machine shop, home work shop, or any shop where tools should be marked for identification purposes.

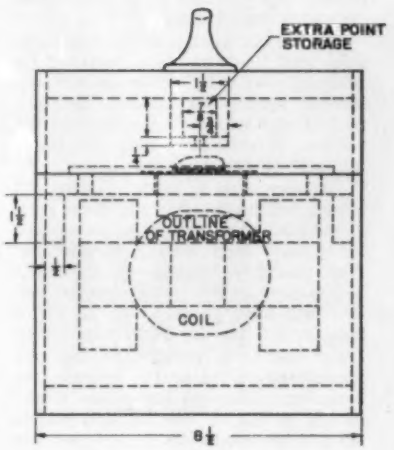
An electric etcher will mark on any ferrous metal. The mark will not rub off or wear away. It will mark on drill bits, steel rules, chisels, saws, and other tempered tools.

Four etching heats of 220, 330, 440, and 680 watts provide a wide range of marking control. The depth of the mark can be varied by the speed of writing or lettering.









Small tools may be marked by placing them on the metal work plate. Larger articles may be marked by connecting them to the work plate with an automobile battery booster cable obtainable at almost any auto supply store.

The Transformer

The most difficult part to make is the transformer. It should have a core size of 1¾ by 1¾ by 4 in. long. The primary should be wound with 440 turns of No. 14 Formvar magnet wire. It will require about 350 ft. or about 4 lb. of wire.

Wind the primary on a 1¾ by 1¾ by 4-in. wood mandrel. To insulate the primary from the core wrap the mandrel with several layers of motor insulating paper. This paper can be held in place with masking tape.

Begin winding the primary by leaving about a 6- or 8-in. lead. Keep the turns tight and closely spaced. If you use Formvar insulated wire, you will not

Bill of Materials

Quantity	*Part*	*Material*	*Size*
3 lb.	Formvar magnet wire	No. 14	
25 ft.	Formvar magnet wire	No. 10	
20 lb.	Transformer iron		
1	Pencil handle	Maple	1¼" x 1¼" x 4½"
1	Pencil point	Copper	¼" dia. x 1⅛"
1	Etcher head	Brass	1" dia. x 1⅞"
1	Work plate	Alum. Alloy	¼" x 6¼" x 6¾"
1	Ohmite tap switch	No. 22	
1	Ground cable connector or machine bolt		11/16" dia. x ¾" ¼" x ¾"
4	F H Woodscrews		¾ — 12
1	F H Stove bolt		¼" x 1½"
6 ft.	Electric cord	No. 12	
1	Electric plug cap		
5 ft.	Electric copper cable	No. 1	
1 pr.	Hinges		
1	Suitcase catch		
1	Handle		
2	Box end	White pine	¾" x 9" x 8"
1	Box top	White pine	¾" x 8" x 12"
1	Box bottom	White pine	¾" x 8" x 12"
2	Box sides	Fir plywood	¼" x 9" x 12"
1	Box removable top	Fir plywood	½" x 8" x 11¼"
1	Cord winder	Maple	¼" x 1½" x 8¼"
1	Block	Maple	1" x 1½" x 5"

need to insulate between the layers. At 265 turns take off a tap by forming a large loop 6 in. long. Mark this tap No. 1, keep on winding and take off tap No. 2 at 310 turns, when the entire 440 turns are on the coil, cut off the surplus leaving a 6 in. lead. The end of the coil must be bound with electricians tape to keep the wire in place. Wrap about 1 or 2 layers of the motor insulating paper to insulate the primary from the secondary. This paper must also be held in place with masking tape to keep it from slipping.

We are now ready to start to wind the secondary. It is wound with No. 10 Formvar insulated wire. It will require 6 turns of 4 No. 10 wires in parallel. Do not use more than 6 turns on the secondary and you must use at least 4 No. 10 wires or their equivalent. Leave at least 12 in. leads at each end of the secondary.

Wrap the secondary tightly with electricians tape to bind it in place. This completes the winding.

Remove the wood mandrel very carefully and bind the coils together by wrapping with small strong twine. Wrap through window and around the coils, bind in each of the four corners of the window. If necessary, wrap the entire coil with electricians tape.

The core may be made from an old burned out transformer purchased from a salvage yard. After removing the laminations from the old transformer, they should be cleaned in a solvent before cutting them to the required size. You will need about 15 or 20 lb. of transformer iron for your transformer.

For the core through the coil, the laminations should be 1⅝ in. wide and 6 in. long. The end lamination should be 1⅜ by 5¼ in. The top and bottom laminations should be 1 by 6 in. The completed transformer core will be 1⅝ by 1⅜ by 6¼ by 7⅜ in.

After making the case, attach the completed transformer to the lower side of the removable cover.

The rotary switch must be of a heavy duty type, capable of carrying at least 10 amperes. It can be either home made or a purchased one designed for a battery charger. It must have at least 4 contact points, and may be obtained from an electrical supply house.

Mount the work plate on the top of the removable cover. The work plate should be ¼ in. thick and may be either aluminum or steel.

Connect one end of the secondary to the lower side of the work plate. The other end of the secondary should be connected to the etching pencil by means of a very heavy flexible cable. A 5 ft. section of no. 1 gauge cable from an arc welding machine makes a satisfactory lead. Solder the cable to the brass etching head.

To use the etcher, slide the etching pencil firmly over the work. It creates a very small arc which melts the surface of the work. If the point sticks or arcs to the surface being marked, too much heat is being used, try a lower setting on the switch. ◀

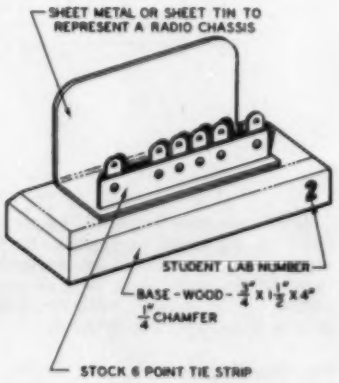
A SOLDERING JIG

ROBERT J. MOUSER
Instructor of Electricity
Neshaminy High School, Langhorne, Pa.

From five years' experience in teaching electronics, the author has learned that most kit and construction disappointments in electronic construction stems from poor placement of parts and — more important — from poor soldering. To meet this need, he has devised a soldering jig. Using it the students have been highly interested in this sort of practice activity and they have experienced less failure.

The most important feature of this jig is the fact that it gives the student soldering practice. In addition, it gives him the opportunity to handle electronic equipment and offers an introduction to some electronic terms. This jig has purposely been made small so that the student will acquaint himself with working in confined space (such as the bottom of a radio or TV chassis). He works with various types of wire. He does not, however, work with real condensers and resistors due to the cost of this equipment. The author has made substitute (dummy) parts for this first job by cutting ⅜ in. diameter dowel rod into 1 in. long pieces and drilling a hole thru it to receive a piece of No. 18 (skinned bell) wire. It is held in the dowel rod by a drop of cement on each end. These parts will stand much wear and are well received by the student.

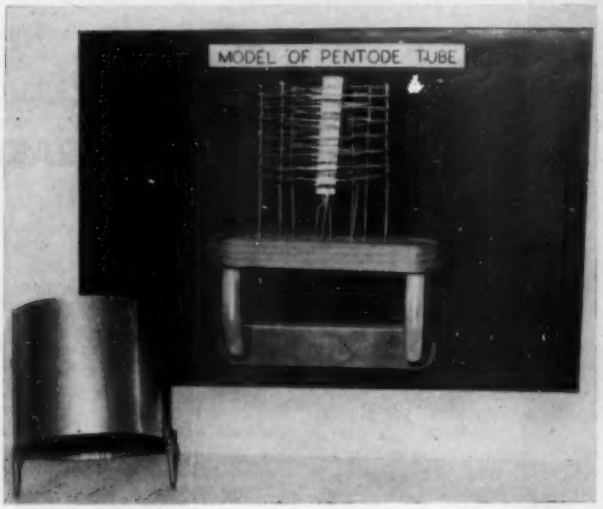
The size of the jig and the other related parts can be varied to suit material available. ◀


SHEET METAL OR SHEET TIN TO REPRESENT A RADIO CHASSIS
STUDENT LAB NUMBER
BASE - WOOD - ¾" X 1½" X 4"
¼" CHAMFER
STOCK 6 POINT TIE STRIP

Bill of Materials

Quantity	*Part*	*Material*	*Size*
1	Base	Pine	¾ x 1½ x 4 in.
1	Dummy chassis	Sheet tin	2 x 3½ in.
2	Screws		½ x No. 4 r.h.
1	Dummy resistor	Dowel rod	⅜ in. dia.
1	Dummy condenser	Dowel rod	⅜ in. dia.
		Scrap wire	
1		Tie strip, six point terminal	

A MODEL VACUUM TUBE



ROGER J. WEAVER

Electronics Instructor, George Washington High School, Indianapolis, Ind.

This teaching aid, which will help explain the internal construction of the four main types of commonly used vacuum tubes, is easily constructed in your own shop from materials readily available there. It is large enough for all of the class to see what is being discussed.

The heater for this model is made up by twisting a pair of 12 gauge bare tinned copper wire. Actually the heater of a vacuum tube is a bundle of folded wire carefully insulated so that the folds don't short circuit to each other or to the cathode into which the bundle of heater wire is pressed. You could even substitute a flat strip of copper to represent a heavy filament of a diode if you desired. The actual heater wire is folded to make it non inductive.

The cathode of the model is a piece of aluminum tubing of about ¾ in. diameter and about 4 in. long supported by pieces of 12 gauge bare tinned copper wire. The outside of the real tube cathode is coated with a white coating of chemicals. To make the model cathode resemble it, coat the outside with white paint. If a July 4 sparkler is available what a fine simulation of emission can be made by lighting it and using it as a cathode.

The three grids are all made of bare 12 gauge tinned copper wire. They are each formed over a round surface such as a metal can. Then the turns are spaced and soldered in place along each side to the supporting wires. The spacing of the turns of real grids varies depending upon the type of tube. Iron wire might be used and spot welded into place if the equipment is available. Iron wire is more rigid and would bend less easily.

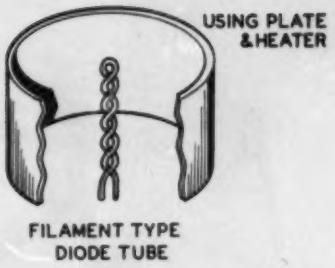
The anode or plate is made of sheet aluminum. It is formed into a cylinder with a lock seam. Make it large enough to cover the other parts of the model tube and give plenty of space between the grids and the cathode. The grids shouldn't touch the plate. The writer thought of giving the plate a coat of flat black paint but since it is in front of a jet black background it would fail to show up as well as a bright aluminum plate would show.

The base of the model is black walnut with holes drilled in it for each of the supporting wires which hold the parts in place. It would be possible to mount the walnut base on a larger base and thus make it possible to hold the model tube upright while on a table top. The model shown is mounted on a panel of plywood covered with glue then black flock (giving it the appearance of black velvet). The panel is mounted in a wide frame much like a shadow box frame finished in turquoise enamel.

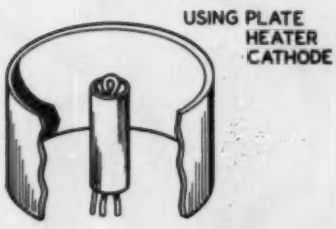
Dusting or spraying with flock causes quite a dust and it is irritating to your respiratory system. Do the work outside if at all possible. It will make cleaning up afterwards much less difficult. Flock goes a long way and can be obtained in a variety of colors. It can be used for different types of display panels.

The sketches show just how the parts of the model may be assembled to demonstrate different types of tubes.

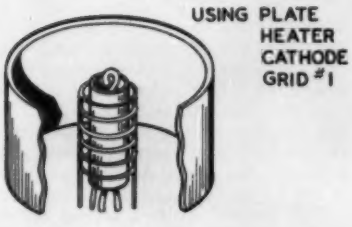
Students can readily construct this model for you and you will find that both student and instructor will be well repaid for their time and efforts. Your teaching will be made much more effective.



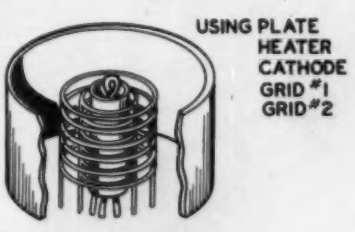
FILAMENT TYPE
DIODE TUBE



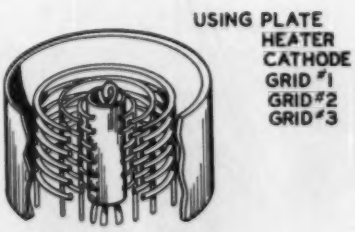
DIODE WITH CATHODE



TRIODE TUBE



TETRODE TUBE



PENTODE TUBE

METAL-BENDING BRAKE

M. C. ANDERSON
Arlington, Va.

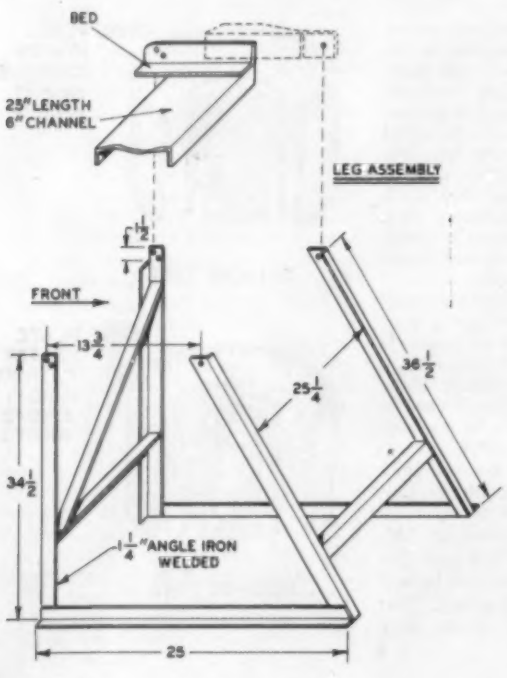
If your school shop can use a sheet metal brake — or perhaps a smaller machine to supplement your present shop equipment — this project will interest you. The work can easily be handled by a group of your more advanced students in metalworking. For this group, such a project has a built-in incentive, since it will be put to actual use in the shop.

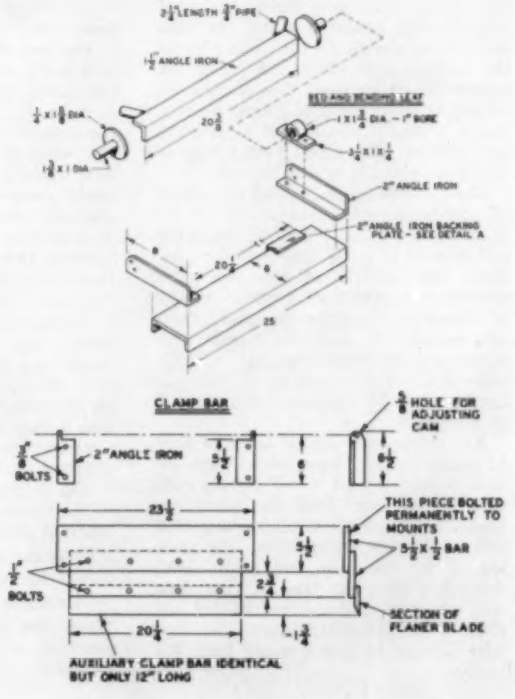
The project involves several metalworking operations: layout, lathe-turning, welding, drilling, tapping, hacksawing, and hand filing. The materials are probably already available in the shop, since nothing hard-to-get was used. The brake shown has been in use for nearly two years now and is entirely satisfactory.

The brake will handle sheet metal up to 16 gauge in thickness and 20 in. in length. The clamp-bar is adjustable for different metal thicknesses. Auxiliary clamp-bars permit handling special bending jobs, such as the forming of box corners.

The brake is supported on angle-iron legs. These are welded up from 1¼ in. angle iron and bolted to the bed of the brake. The leg assembly could be designed for bolted rather than welded construction, if you will have to have your welding done.

A 25 in. length of 6 in. steel channel





serves as the bed of the brake. Support pieces for the bending leaf and clamp are cut from 2 in. angle iron.

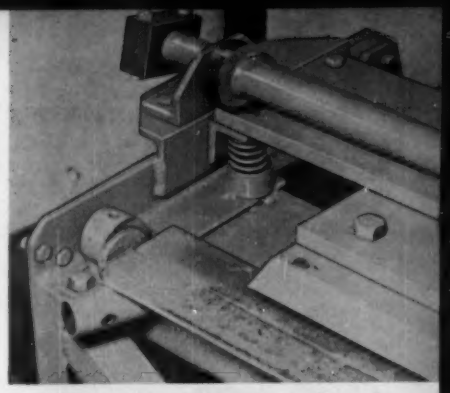
The Clamp Bar

The clamp-bar support is cut from ⅜ by 5½ in. steel bar. The clamp-bar shown was made from a length of discarded planer blade with the cutting edge ground to a radius. You may be able to get a set of worn-out planer blades from your local lumber yard. If not, the clamp-bar can be made up from other stock and milled or filed to shape. Almost anything available with this cross-section will serve, since the bar has good backing. Planer blades have a hardened cutting edge which cannot be cut with the hacksaw. Cut through the soft back of the blade to the hardened edge, then break this by clamping the blade in the vise and snapping it off quickly. Grind the ends smooth.

The cams which actuate the clamp-bar are turned in the lathe. Easiest method is to turn and drill the cams and then weld them onto the shaft. Turn the outside of the cams true and cut them off to length. Then clamp the cam in the 3-jaw chuck with a ⅛ in. spacer under one jaw and drill the center hole. This will give a ¼ in. cam action. Make certain both cams are mounted in the same position when they are welded to the shaft. The cams could be made without the use of a lathe, if necessary, by cutting off sections of round-stock of the proper length and diameter. Mark and drill the shaft holes ¼ in. off-center.

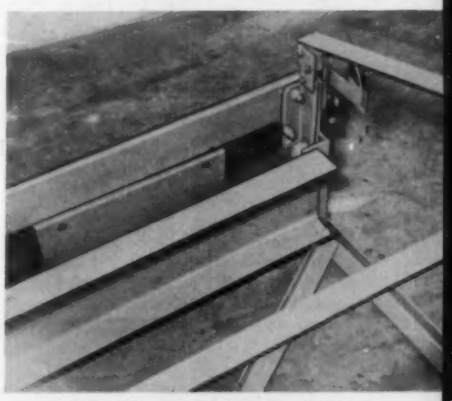
The clamp-bar is held against the operating cams by a pair of auto valve springs. This makes the clamp self-releasing when the lever is thrown to remove the work.

The bending leaf is made from a length of 2 in. angle iron, with pivots welded to each end. To work properly, the corner of the angle iron must be on the axis of rotation. This is the only part of the brake which requires careful fitting if the brake is to operate properly. Square the ends of the angle iron in the lathe or by cutting-off in a power saw. If these are not available, make the cuts carefully by hand and then square up with the file. The end pieces which form the pivots for the bending leaf may be turned in one piece as shown, or built up from two pieces. These pivots must be accurately positioned and welded on the ends of the

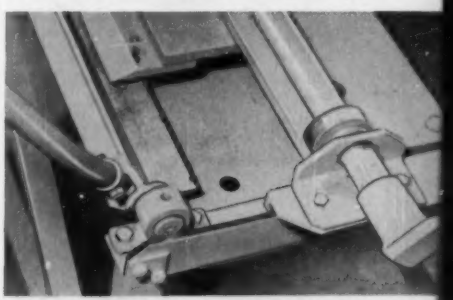


Auto valve spring returns clamp bar to open position.

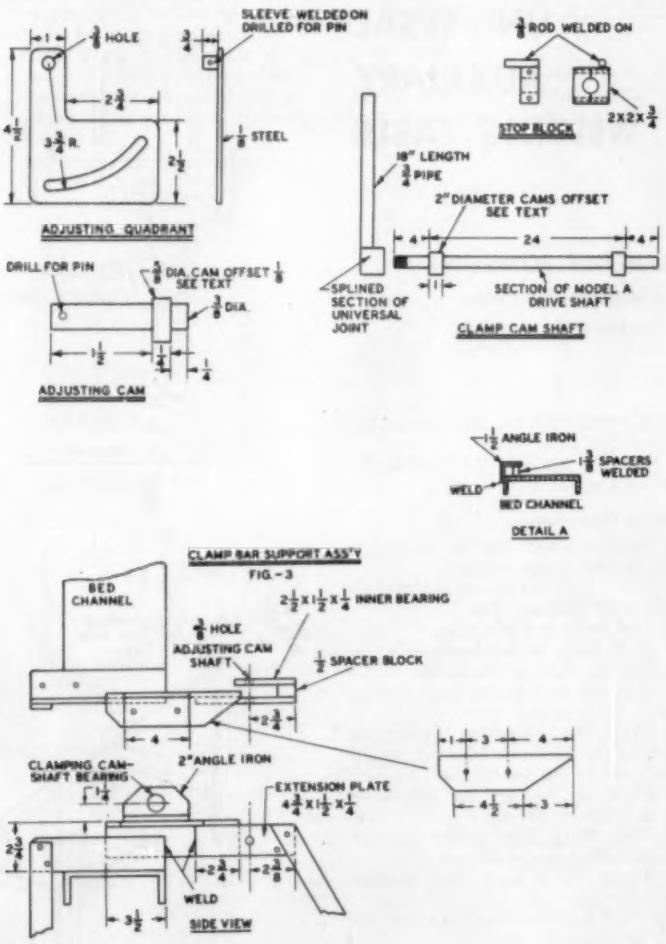
Quadrant adjusts clamp bar for differing thicknesses.



Bed of channel iron on bottom.



Bearings for bending leaf and bar.



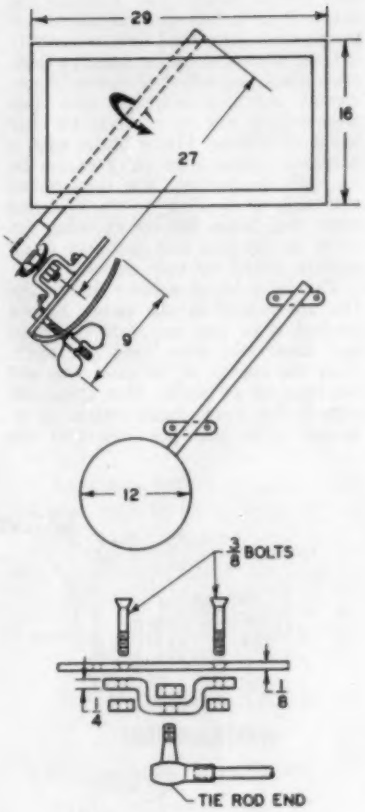
bending leaf. Do this after the frame and base are assembled. Mount the pivot bearings, making certain they are in proper alignment. The bearing-centers must lie on a line with the face of the angle iron member which backs up the bending leaf. Place the pivots in the bearings, and slide the angle iron bending leaf into position between them. Clamp it securely to the angle iron backing member, using *C* clamps.

When everything is in alignment, the pivots are tack-welded to the bending leaf, which may then be removed to finish the welds. A pair of handle sockets, made from ¾ in. pipe, are welded to the leaf as shown in the drawings.

Thickness Adjustment

The heart of the assembly is a shaft with a cam in the center. This is turned in one piece (or may be built-up) from 1 in. diameter stock, leaving the cam portion oversized. When the shaft is finished, the piece is chucked off center by clamping a 1/16 in. shim under one jaw of the chuck. The resulting cut will produce a cam with a ⅛ in. throw, sufficient to adjust the clamp-bar for any metal thickness that will be bent. To mount and lock these adjusting cams, a ¾ in. long sleeve is welded to the outside of the adjustment quadrant and a hole drilled through both sleeve and shaft for a locking pin. In mounting the adjusting cams, make certain that both cams operate in the same direction. Position of the lobe may be marked on the end of the shaft for reference when assembling. After the clamp-bar and adjustment assembly are mounted, the adjusting quadrants can be marked off for the different thicknesses of metal by clamping a sheet and adjusting the bar to contact the work at both heel and toe. These positions may then be marked on the quadrant with scriber or metal stamps.

The bending and clamping handles are made from any suitable bar stock. A coat or two of good machinery enamel completes the project. ◀



UNIVERSAL AUXILIARY WELDING TABLE

MARION E. MADDOX and CLARENCE JOHNSON
Associate Professor and Student of Industrial Education
University of Arkansas, Fayetteville

This universal auxiliary welding table is mounted on heavy tie-rod end and supporting shaft. It can be attached to a regular welding table. All parts are of iron to withstand heat.

Materials

1 Heavy truck tie-rod end.

1 Shaft 29 in. long, of sufficient size to attach to tie-rod end and strong enough to support the auxiliary table and working load.

1 Strap of iron ¼ by 1 by 7 in. long, for attaching auxiliary table top to the tie-rod end.

1 Strap of iron ¼ by 1 by 9 in. long, for clamp bar to hold work to the auxiliary table while being welded.

1 Iron ⅛ in. thick and 12 by 12 in., may be left square or cut round.

2 Bolts ⅜ by 1 in., with flat heads, for attaching the supporting bracket to the auxiliary table top.

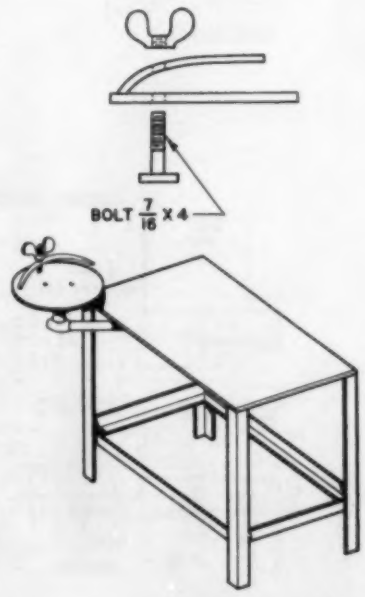
1 Bolt 7/16 by 4 in. with wing nut, for clamp bar.

2 Straps of iron 3/16 by ¾ by 2½ in. long, for mounting the shaft under the large welding table top.

4 Bolts for attaching the shaft to the large welding table.

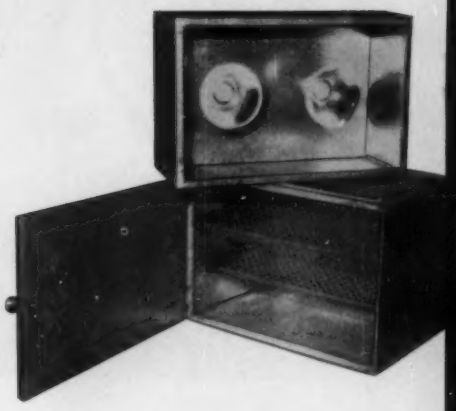
Steps in Procedure

1. Attach tie-rod end to the shaft. (May be welded or clamped.)
2. Cut 2 irons for clamping the shaft to the large welding table.
3. Drill holes in the 2 irons.
4. Drill holes in the large table for clamping the shaft to the table.
5. Bolt the shaft to the large welding table.
6. Shape the supporting bracket for attaching the auxiliary table top to the swivel bolt in the tie-rod end.
7. Place the bracket on the swivel bolt and tighten the nut.
8. Drill the 2 holes in the auxiliary top and bolt it to the bracket.
9. Shape the strap of iron to form the clamp bar.
10. Drill hole in clamp bar and bolt it to the auxiliary table top. ◀



INEXPENSIVE PLASTICS OVEN

GERALD L. STEELE
Chairman, Industrial Arts Department
Orono Public School, Long Lake, Minn.



This inexpensive oven was designed and built by the instructor at a total cost of about $10.15.

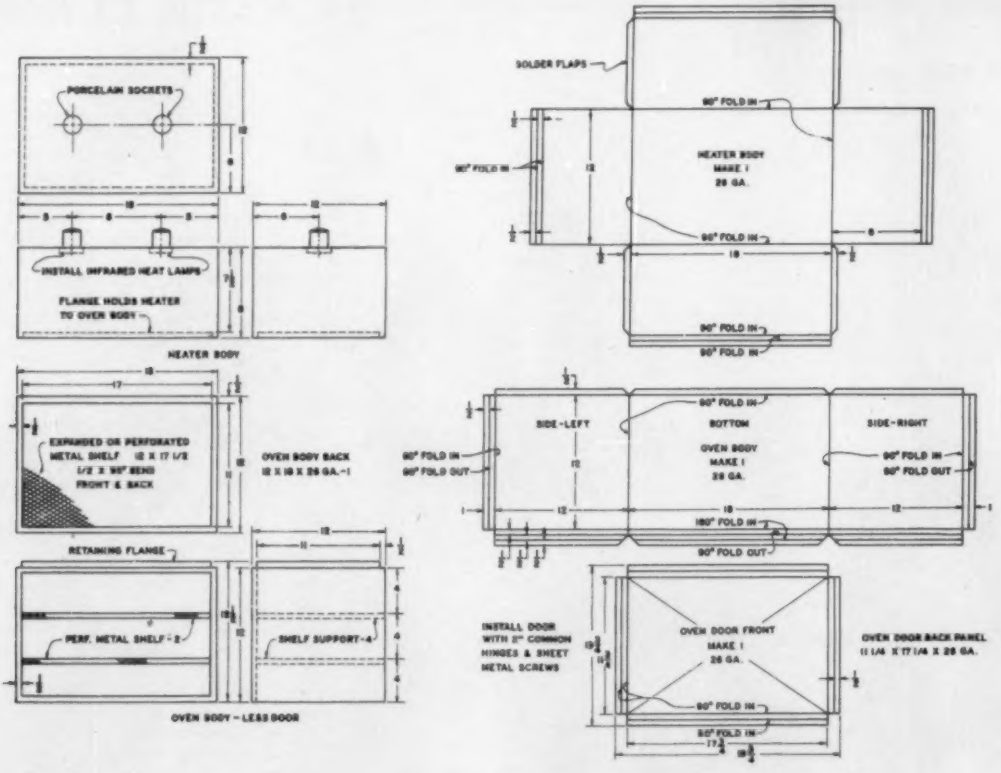
To make the oven you need to cut out the five main parts from 26 ga. galvanized sheet iron as indicated in the drawings. Bend the pieces to shape in a box with a pan brake or between two pieces of angle iron clamped together. The flanges around the door on the front of the oven body are bent in so there are no sharp edges that one can get cut on when working rapidly with hot plastic. After forming, the parts of the oven may be soldered, riveted, or spot welded together as one sees fit. The original model was soldered at all joints. The shelf brackets are formed from scrap pieces of sheet metal and riveted into the body. The shelves are cut from expanded or perforated sheet metal and bent down in front and up in back to give them strength. They are removable to allow use for other purposes.

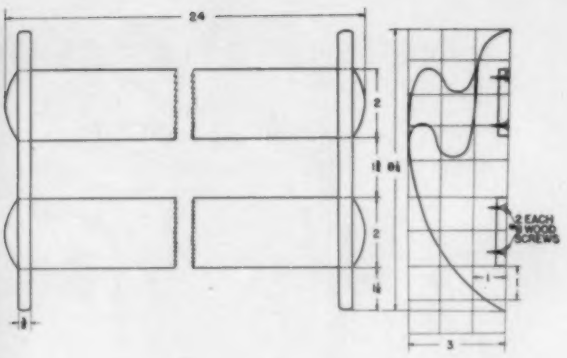
The heater body is removable so it can be used as a separate heater unit over a vacuum or pressure forming jig. This feature makes it more versatile in the small shop.

The electrical wiring has been deliberately kept simple to cut down on the cost of the unit. Two short pieces of electric iron cord have been used with inexpensive plugs on the ends. An extension cord with a multiple socket is used to supply current to the two units. Infrared heat lamps supply the needed heat and do a rapid job. One-eighth-in. acrylic (Plexiglas or Lucite) plastic can be heated for bending in four to five minutes. Due to the rapid heating, care must be taken not to leave the plastic in the oven too long as bubbles may appear on the surface of the plastic.

Temperatures of 375 deg. can be reached on the top shelf, 250 deg. on the lower shelf and 175 deg. on the bottom of the oven. The difference in temperatures is due to the type of heat produced by infrared lamps. No insulation is necessary on the oven as the heat loss is just about right to maintain proper temperatures.

Gloves should be used to handle hot plastic. Many fine projects can be made from bent plastics and may be used successfully in grades 7 through 12.


PORCELAIN SOCKETS
INSTALL INFRARED HEAT LAMPS
FLANGE HOLDS HEATER TO OVEN BODY
HEATER BODY
SOLDER FLAPS
90° FOLD IN
HEATER BODY MAKE 1 26 GA.
90° FOLD OUT
EXPANDED OR PERFORATED METAL SHELF
OVEN BODY BACK
RETAINING FLANGE
PERF. METAL SHELF - 2
SHELF SUPPORT - 4
OVEN BODY - LESS DOOR
SIDE - LEFT
BOTTOM
SIDE - RIGHT
OVEN BODY MAKE 1 26 GA.
180° FOLD IN
INSTALL DOOR WITH 2" COMMON HINGES & SHEET METAL SCREWS
OVEN DOOR FRONT MAKE 1 26 GA.
OVEN DOOR BACK PANEL



A FUNCTIONAL GUN RACK

WILLIAM E. MAYER, JR.
Student of Industrial Arts
State University of New York at Buffalo

"What is required in order to create a functional gun rack that could be fastened to any type of interior wall?" This was a design problem the writer had in the industrial arts woodworking laboratory at the State University College of Education at Buffalo, New York.

This resulting gun rack lends itself to a wide variety of materials and processes. It can be used as an individual experience or adapted to a mass production line. Clear acrylic plastic and poplar were combined in the design of the rack. Simplicity of line and form permits the use of this article in a variety of room decors.

This particular form consists of two pieces of Plexiglas (¼ by 2 by 24 in.) which make up the cross panels, and two end brackets of poplar (¾ by 3 by 7¾ in.). Fastening the rack to the wall can be accomplished according to the type of wall on which the gun rack will be placed.

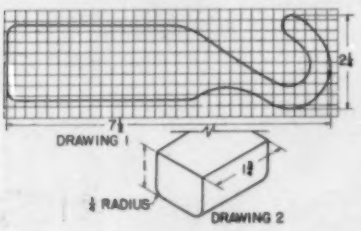
Perhaps the best feature of this gun rack is that its design lends itself to a variety of materials. Aside from the wood the end brackets could be made from plastic and the cross panels could be made from wood or metal. With a little imagination this rack can be altered to receive any rifle.

A PLASTIC TIE HOLDER

TOM ROGERS
Warrensville Heights High School
Cleveland, Ohio

This plastic tie holder is the result of many frustrating mornings trying to get the right tie out and not to have the remaining ties fall to the floor.

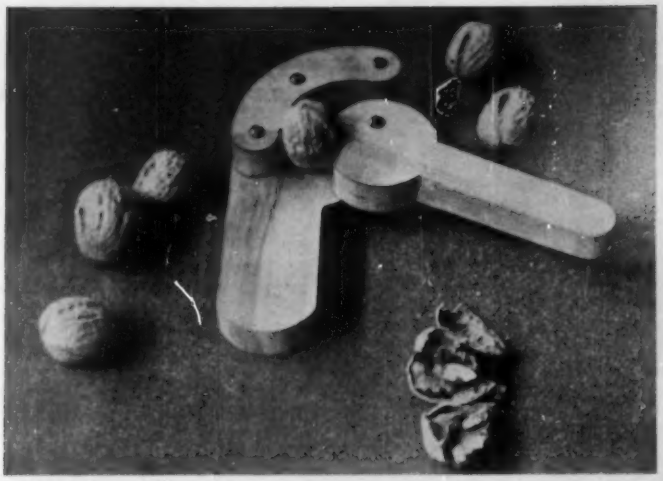
The tie holder is a small item and can be placed right on the rod in your closet. The tie holder is light in weight and can hold as many as 30 ties. It holds narrow ties, wide ties, or both types if you prefer. It does not require an engineer to operate this little gem. Simply hang your ties over the plastic hook; when you need a tie, all you do is select the one you wish to wear and pull it out from the holder. Whether it is the top tie, the middle one, or the bottom one, just pull the tie toward the front of the holder and lift the tie as it reaches the front bar. The other ties will remain in place without any straightening or picking up to do. When you are ready to replace the tie just place it on top of the others. Now doesn't that seem easy?

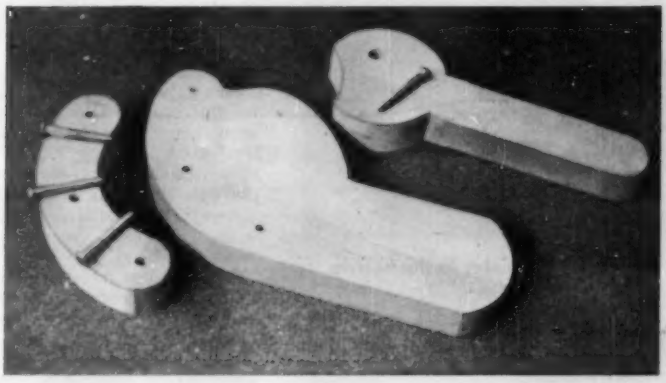


With this one project we can teach the students many of the basic procedures involved in working with plastics. A few of the basic steps are the cutting of plastics, filing the edges, sanding and polishing, and the forming of plastic. To the enterprising industrial arts instructor, design and decorating can also be added to this project before the forming process. Patterns, initials, cutouts, and internal carving will add much to the finished project.

Procedure

1. Select the plastic and cut out the basic design of the tie holder.
2. Sand and finish all edges. Be sure to have the hook portion of the holder perfectly round as this will effect the way it will hang.
3. Select the pattern or the design for the front bar.
4. Heat the plastic until it becomes pliable and then form it. If you do not have a plastic oven at your school, try heating water on a portable hot plate, and leave the plastic in the water until it is pliable.
5. Form the tie holder around a jig cut from scrap wood. Be sure your jig is smooth as each mark or scratch will show up on the plastic tie holder.





ECCENTRIC NUT CRACKER

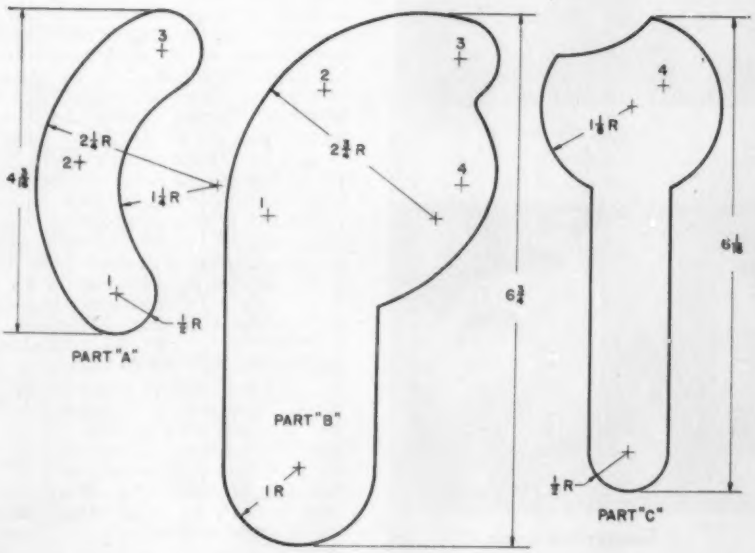
LEON I. REISSMAN
Teacher, Industrial Arts
J.H.S. 12, New York City

This unusual nut cracker is quite simple in its construction, yet is capable of exerting sufficient pressure to crack and shell many varieties of nuts.

This project lends itself very easily to the wood area of the general shop or the arts and crafts shop and of course the wood shop. The student will be tempted to select this project because of its uniqueness as well as its usefulness in the home. To the instructor, it is a way of demonstrating eccentric action and cam principles as well as teaching mechanical construction, use of material and design.

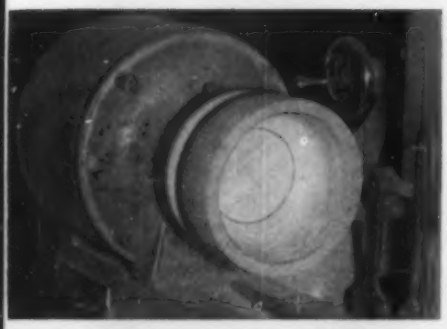
Construction Details

1. Lay out and trace the outline of the parts onto the piece of wood.
2. Use a coping saw to cut the shapes.
3. Sandpaper rough edges and bevel edges.
4. Drill clearance holes for No. 8 wood screws (No. 3/16 twist drill) in parts marked *A and C* only and in spots indicated by numbers 1, 2, 3, 4. (The arm part "C" is eccentric; it is drilled and mounted off center allowing it to swing open to accept nuts of assorted sizes.)
5. Assemble as shown.

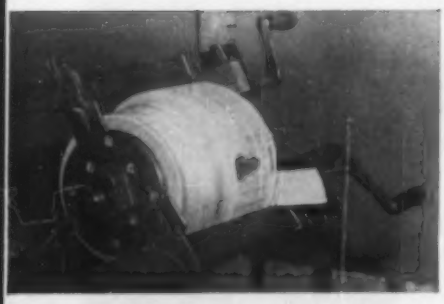


COOKIE JAR

LOUIS BAROCCI
Instructor of Woodworking
Cudahy, Wis., High School



Turning the bottom.



Gluing the center to the bottom.

Turning the center.

Turning the inside.

A turned cookie jar of sufficient depth is an unusual project and at first glance seems impossible to make because of the deep internal turning. Through experimentation in the school shop, we found that it can be easily turned by following the subsequent instructions.

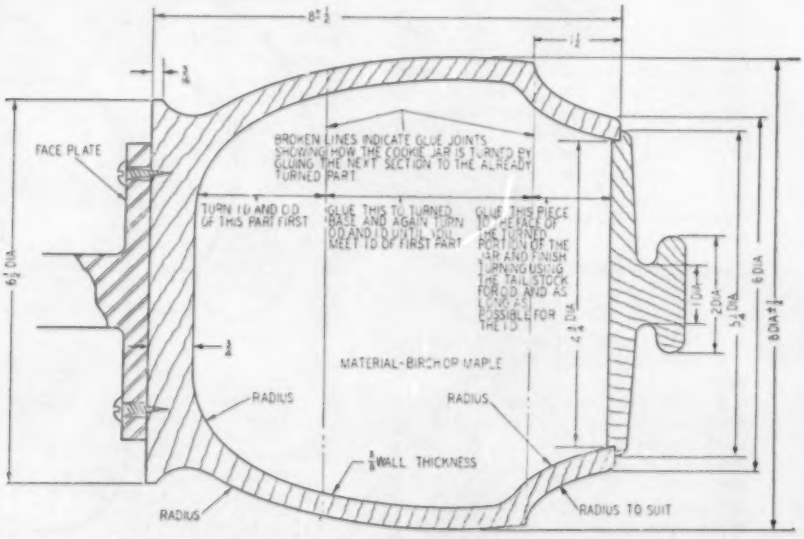
Almost any clear stock can be used for this project. Glue up, face to face, using bar clamps, five pieces of S.2.S lumber ¾ by 9 by 20 in. The gluing should be done carefully so not to mar the two outer surfaces with the bar clamps. (If you have access to 4 by 9 in. wide stock, the gluing operation is not necessary.)

The next day remove the clamps from the stock and scribe two 9-in. circles on the poorer side of the glued-up stock and cut them out on the band saw. These two pieces will eventually be glued face to face, so be careful not to mar or nick them in any way.

Screw the faceplate to one piece and turn the inside bottom half and the outside contour of the cookie jar. The next operation is to glue the second piece of stock face to face with the turned piece. Remove the faceplate from the lathe, and with four bar clamps glue the second piece to the already turned stock.

The next day, remove the bar clamps, and with the tailstock center locked tightly against the stock, turn the outside contour of the cookie jar and as much internal turning as can be done with the tailstock in this position. At this stage, remove the tailstock and do the remaining internal turning until you meet the bottom half that is already finished. When you have sanded the inside and outside thoroughly, you are ready to turn the cookie jar lid cover.

A screw faceplate is used to turn the cover. Select a piece of stock to match the cookie jar ¾ by 6 by 6 in. Glue at its center another block ¾ by 2 by 2 in. Screw the screw faceplate in the center opposite the ¾ by 2 by 2 in. block and turn the lid as per the drawing. Check frequently to see that the lid fits the jar snugly. The entire cookie jar is now ready for the final sanding and finishing. Clear lacquer makes an ideal finish for this project.


8"±½
1½
¾
FACE PLATE
BROKEN LINES INDICATE GLUE JOINTS SHOWING HOW THE COOKIE JAR IS TURNED BY GLUING THE NEXT SECTION TO THE ALREADY TURNED PART
TURN TO AND O.D. OF THIS PART FIRST
GLUE THIS TO TURNED BASE AND AGAIN TURN O.D. AND D. UNTIL YOU MEET TO OF FIRST PART
GLUE THIS PIECE TO THE FACE OF THE TURNED PORTION OF THE JAR AND FINISH TURNING USING THE TAIL STOCK FOR O.D. AND AS LOW AS POSSIBLE FOR THE D
6½ DIA
⅛
MATERIAL-BIRCH OR MAPLE
RADIUS
RADIUS
⅛ WALL THICKNESS
RADIUS
RADIUS TO SUIT
6 DIA
8 DIA±½

Adapted from the author's Wood Projects You Will Like, The Bruce Publishing Co., 400 N. Broadway, Milwaukee 1, Wis., cloth, 126 pp., $3.95.

A STAPLING DEVICE

CARL H. HUBACHEK
Instructor of Industrial Arts
Branford, Conn., High School

During the course of a year many papers are stapled together by both the students and the instructor.

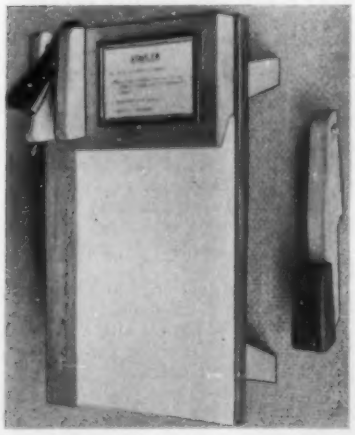
Usually the papers have to be neatly arranged first, and then they are randomly stapled with the results being that the papers are not always evenly stacked and the staples are not always most effectively placed. This is particularly true in the case of the younger student.

The object of the device shown in the accompanying photographs is to make it easy to stack a number of papers neatly and to cause the staple to be placed in a predetermined place in the upper left hand corner of the papers. This particular device was designed to principally accommodate 8½ by 11 in. paper when the paper is used with the long dimension vertical.

When the papers are placed on the bed of the device so there is no overhang all papers in a group will be lined up and the staple will be applied in the proper place and will go through all the papers. Papers placed on the device in a disarranged manner can easily be neatly arranged by tapping them gently at the bottom and at the right side before they are stapled.

This manner of stapling papers has proved quite satisfactory for use by the students in fastening their plans together and by the instructor for fastening plans, job sheets, instruction sheets, quizzes, and tests together.

To make this unit a Bostitch B-8 stapler was used, but any other make could be adapted.



The plastic base of the stapler was removed to make it easier to fasten the stapler to a board. The metal base was then screwed into a routed out section in the face of the plywood bed. The gauges at the left and top are so placed that the staple is driven through the papers ⅜ in. from the top of the paper and so the end of the staple is ¼ in. from the left edge of the paper.

The dimensions of the bed and of the gauges should be so arranged that the papers to be stapled fit on the bed with the right edge and the bottom edge of the papers flush with the right edge and the bottom edge of the bed.

The wood at the ends of the gauges near the stapler are cut out so the head of the stapler can pass below the top surfaces of the gauges. If this precaution is not followed the stapler cannot be pressed down far enough to apply the staple through the papers.

Because the stapler itself must be depressed below the tops of the gauges a new lever must be added. The new wood lever has a ¼-in. dowel through the back end. This dowel fits in a slot at the back of the device making it easy to remove the wood lever to service the stapling machine underneath. Not only is the new lever necessary it also makes it even easier to staple papers because of the double lever now present.

To date four of these units have been made and are in constant use. One of the units is used to staple a monthly news letter of eight pages or so which is sent out to a minimum of 100 people. ◀

TREE SPECIMEN DISPLAY

JAMES SCHILLEMAN
Pilgrim Park Junior High School
Elm Grove, Wis.

The display case pictured is one of 50 such cases which have been developed by the writer as an aid in the teaching of tree and lumber identification. Each tree considered for this collection yields commercially important lumber and is found growing in the United States except for a few which represent popular school shop woods that are imported from foreign countries.

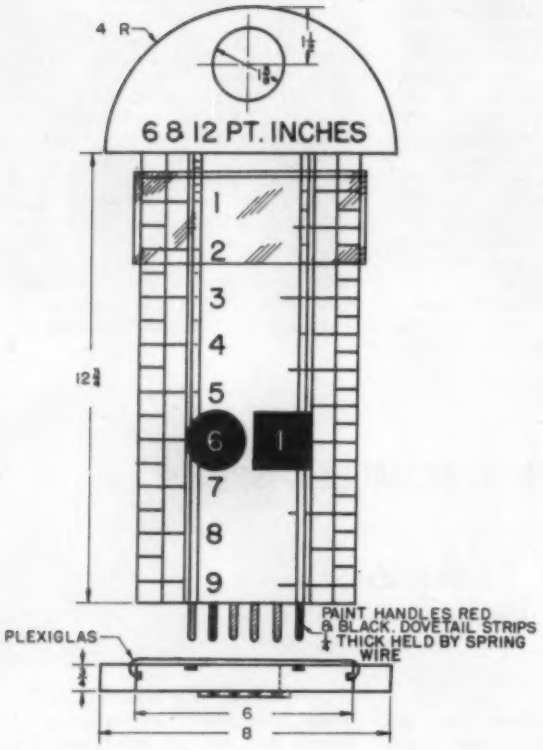
Most of these herbarium materials were collected first hand by frequent visits in the woodlands of the midwest. Some were sought out and contributed by friends living in the western pine region and in the southern forest of the United States. The foreign species were obtained through several commercial buyers of foreign woods and through service personnel abroad.

Much of the original color of the leaves, buds, blossoms, etc. has faded with age but in its entirety, the display adds much to the decor of a woodworking shop. Each case has glass over its front for protection purposes as well as to insure cleanliness.

Specifically, each case contains the following items:

1. A piece of old and/or new bark approximately 4 by 6 in. in size.
2. A sample of the raw wood.
3. The seed or fruit of the tree.
4. A bud and/or blossom of the tree.
5. A description sheet containing the following data: (*a*) genus, (*b*) the principal lumber specie names, (*c*) grain texture, (*d*) comparative strength, (*e*) finishing properties, (*f*) degree of warpage, (*g*) comparative weight, (*h*) the general size of the mature trees, (*i*) where it is grown in abundance, (*j*) general uses, and (*k*) other interesting data pertaining to particular uses, peculiar characteristics, unusual growing features, etc.

To supplement this display, the writer has another of some 80 boards ¾ by 6 by 30 in. in size which better reveal the lumber. Each is sanded on four sides and is finished with clear varnish on the best surface. Neither display is complete by any means but they serve the purposes for which they were intended. ◀



LINE GAUGE TESTER

BERNARD J. VESELY
Instructor of Graphic Arts
Whiting, Ind., High School

Learning a new measuring system when one is not thoroughly sure or reasonably well acquainted with an old one (such as the inch system) is somewhat confusing to new students of printing.

The enlarged scale, devised to check a student's ability to measure with both nonpareil and inch scales is a portion of a regular 12-in. line gauge. It has an advantage over the real object in that group demonstrations can be given and proportions or sections of each division are more easily seen.

One testing strip is inserted in the slide and an explanation given of each dot or proportion of the scale being taught. If the student has the idea of what the procedure is, a new strip is inserted and the student is on his own in answering the query of that particular strip. Additional check strips are inserted in the slides underneath the tester.

In operating the line gauge tester, the amber sliding section is moved from zero position so the line is above a mark on the test strip. Following the line to the scale and reading the proportion or part of either scale is a problem for the student to answer.

Test strips with red handles are for the nonpareil and pica side, while those in black are for the inch side. Additional strips can be made or as on this aid, additional problems can be inserted on the strips in colors and marked thus on answer sheet the student is to turn in, or follow, on a verbal test.

Construction of Line Gauge Tester

Draw an accurate layout of the project to the dimensions listed, or, if you prefer, to a smaller or larger size. One easy way to secure the proper proportions, is to photograph a line gauge, develop the negative and project it to the size you wish. Ascertain the position you wish for the sliding strips. Using the accompanying layout, the bill of materials include: one piece of wood, ¾ by 6 by 17 in. and seven pieces ¼ by ⅜ by 14 in. and one piece of Plexiglas 1/16 by 2½ by 8 in.

The six-in. piece of material is first grooved for the sliding strips and grooves on each side for the Plexiglas slide. Tilt the saw table (or arbor) approximately ten deg. to cut the grooves for the dovetail strips. One-fourth in. opening on surface and approximately three-eights at bottom of groove, one-fourth in. deep. Make cuts entire length of piece.

While saw table (or arbor) is tilted, bevel the strips to fit the grooves with a little play (to allow for painting) so they will slide freely. Use a piece of scrap wood to make strips to fit tightly in the groove at the top end of line gauge from the zero point of gauge to rounded end.

Now that the strips are cut and the grooves made and partly plugged, the saw table (or arbor) can be leveled again for groove cut of Plexiglas slide. Make this the width of the saw cut or even a trifle deeper.

Mark off the curved end with compass, and cut off on band saw. Hold scrap in place to complete the 4 in. radius, mark, and cut the two pieces which can be glued on. Plug the groove openings, sand the circular part, drill the hole, and smooth all surfaces of the entire piece.

Cut one of the strips into 2 in. lengths, to be nailed on back to provide slide places for the extra strips. Make a stop strip also.

The handle part of the strips can be rounded with sandpaper or smooth file. After painting them, indicate by small dots the dimension or number of points you wish the student to read on the proper scale.

The teaching aid should first be sealed, then given two coats of aluminum paint. The lines can be put on with a painter's wheel or brush; lettering and numbers with India ink or paint.

The Plexiglas slide is easily bent on a form after heating.

▶ an instructional procedure, using an electric rule panel, on —

TEACHING THE RULE

CECIL SANDERS
Industrial Arts Teacher, School No. 9
Industrial Arts Department

In junior high school shop classes, learning to read a rule seems to be a difficult task. One does wonder why this is so when instruction on fractions is started in the second grade.

In Indianapolis the second grade is taught to read the whole numbers and the halves on a rule. In the writer's seven years of teaching, however, he has failed to have a beginning shop class read a rule efficiently.

Instructional Procedure

To help the boys learn the rule, this method was tried. On the first day stress was placed upon the need and the reasons for knowing how to read a rule. The students were told how industry uses different kinds of measurements and how they are applied in production. To give some history of measuring, a set of charts that the writer received from Ford Motor Company was placed on the bulletin board.

The next thing that was done was the use of the chalkboard on which were drawn some circles, rectangles, etc. These were divided into the common fractional parts that would be found on a rule. This was done to try to get the boys to see how each fractional part is related to each other. At the close of this class session each boy was given a paper with a representation of an inch with each fractional part of the inch listed. This went to the 1/16-part of the inch. The boys were instructed to memorize the order of the fractional parts.

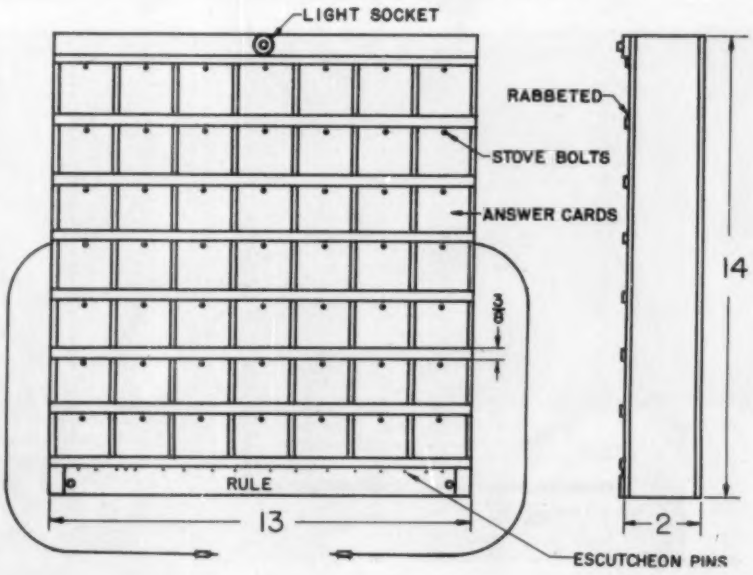
The next class session was taken up with a review of the rule. A large mock-up of the rule was placed on the chalk ledge. This mock-up is about 8 inches wide and 4 feet long. It is divided into the first 3 inches of the rule. The teacher took his pointer and pointed to a reading and then he would call on some boy to give this reading. They were not allowed to use any helps until after a good try. If they failed to read it then some one would help them in the reading or they could refer to their paper with the fractional parts listed.

The next class meeting was taken up with review of the first part of the period. After the review the boys were given a test on the rule. The test was made up of a representation of the rule. It was drawn to actual size down to the sixteenths. At the bottom of the rule were points marked A, B, C, etc., with arrows from the letter to the exact point to be read. On the bottom section of the test paper were A, B, C, etc., with a short line at the side. On these lines the boys were to place the reading of the different points. On line A they were to place the reading of what the arrow is pointing to at letter A under the rule. The letters are mixed under the rule.

If the boys failed to get 75 per cent or better correct, then another test was given which was much like the first test only a different set of reading points were given. If they failed again to get 75 per cent or more then they were sent to the electric rule panel, a device made by the teacher to help teach the rule.

To work on the electric rule panel, the boy was given a 3 by 5 card. On this card is placed 10 readings that he is to locate. These 3 by 5 cards are made up by the teacher or some of the students. The readings on the card are the same that are on the answer part of the electric rule panel. The teacher, or another boy working with the student on the panel, keeps score of how many tries it takes him to find the correct answer. If he has to take more than one try on 7 or more of the readings to be found, then he is given another try with a different card. Before the second card is given, the student is to spend some time in study.

Even those who passed the first two tests are given a card and a chance to see what they can do. Most of them will pass it at once. They do not like to be left out so they get their turn. Often these students are teamed with those who failed so that they can get help and review in seeing these boys select the correct answers.



Making the Electric Rule Panel

The electric rule panel is a box 2 in. high, 13 in. wide, and 14 in. long. A piece of ⅛-in. plywood was used for the top face and the back. At the bottom of the panel is a regular foot rule. This was fastened on with two screws. This rule was drilled with a 1/16-in. drill at the reading points desired before it was mounted to the panel. As many reading points can be used as the teacher wishes. Brass escutcheon pins were then placed in the holes drilled in the rule. The escutcheon pins must be long enough to go through the rule, the facing material and enough sticking through to solder a wire to it.

The remainder of the top face was layed off into the same number of answer places as reading points on the rule. At these location-of-answer-places, a small hole was drilled for a small stove bolt. Enough stove bolts are needed for each reading point that is drilled for an escutcheon pin.

After the stove bolts are put in place, little strips of wood 3/16 by ⅜ by 13 in. are located. These strips have the edge rabbeted a little so a card could go under the edge. The top and bottom strips have only one edge rabbeted but the others have both edges rabbeted.

On the underside of the top panel is the wiring. All of the wires are cut the same length. One wire is needed for each stove bolt or escutcheon pin. Stranded wire was used because it is flexible and will not be easily broken. Each one of these wires was soldered to the escutcheon pin. The other end of the wire was soldered so the strands would stay together. This end then was placed around a stove bolt.

The reason for the wires all being the same length was the panel then can be changed whenever the teacher so wishes. It has been found that after a boy works on the panel a little while, he learns location of the answers rather than the rule. By changing the wires from time to time, this does away some with this problem. Whenever the wires are changed, one must be sure to change the answer cards to the correct place. If this is not done the boy could be taught the wrong readings.

After connecting the wires, place a small socket on the top face of the panel. Run the wire from the socket to the underside. Then locate where the dry cells are to be. Whatever size bulb is going to be used is going to determine how many dry cells to use. One of the wires from the light socket is brought to the brass strip at the end of the dry cells. The other wire from the light socket is brought out of the side of the panel. It must be long enough to reach on the top and have some slack in it. This wire will have a phone plug fastened to it.

On the opposite side of the panel is another wire with a phone plug connected to the dry cells. This wire is to the opposite end of the dry cells of that of the socket wire.

If the panel is wired correctly, it is a series. To make the light come on, one phone plug is placed on an escutcheon pin at the rule. The other phone plug is placed on the right stove bolt. This completes the circuit. The light will come on.

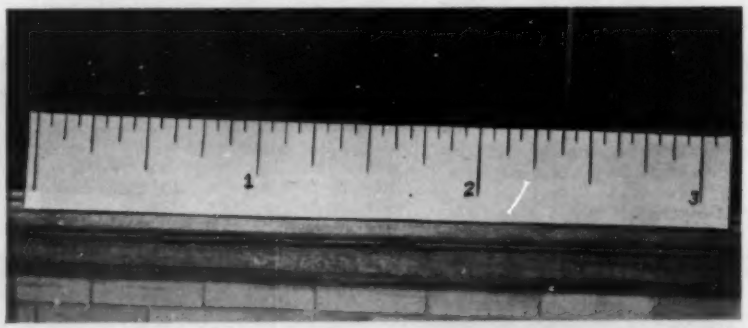
A little caution must be used when the panel is varnished. The escutcheon pins and stove bolts must be cleaned. If this is not done contact will not be made.

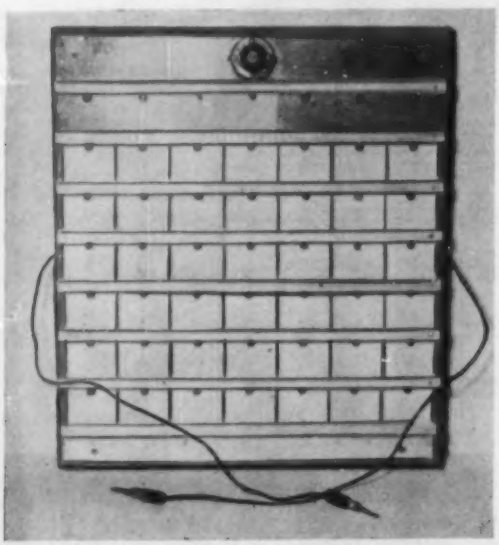
Little cards are then placed between the sticks. Holes are punched in the cards so the heads of the stove bolts can be contacted with the phone plug.

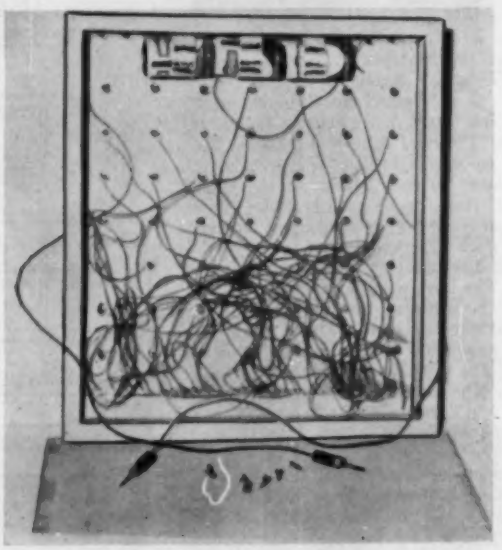
In drilling the holes for the rule, the writer drilled only the fourths and half in the first inch. Between the first and second inch all of the readings of the eighths were drilled. Between the second and third inch all of the sixteenths were drilled. After the 3 inch mark through to 12, the reading points were mixed.

A back is placed on the panel so the boys cannot tamper with the wiring. This was put on with 6 flat head screws.

At the right is a mock-up of a rule used in teaching the rule. Below is a front view of the electric rule panel and below, at right, is a view of the panel with the back removed to show the inside.







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Beware the Project

ELBERT L. GARDNER

The industrial arts project assumes many forms ranging from wooden tie racks to ceramic wall plaques. The emphasis placed upon the construction of these "useful" articles is somewhat alarming when viewed in the light of the flaming exhaust of a rocket blasting off from Cape Canaveral or a Russian base on the Caspian Sea heading for outer space.

There is little room for a course in "project construction" in the already-crowded public school curriculum with its necessary emphasis on science and mathematics. However, an industrial arts course that fulfills the aims of general education has a very important role to play in the liberal education of our youth. General education is that education which is needed by everyone, regardless of sex or future occupation, for effective membership in our modern democratic society. While taking a mental roll call of the areas of knowledge generally recognized as being necessary for acquiring this type of education, the ommission of one most important area is conspicuous — comprehension of American industry.

No one can dispute the dominating influence of modern industry upon the economic and social structure of American society. Inasmuch as this society is primarily technological in nature, it is imperative that all youth have an understanding of the industrial basis of society. As a field of study it is far too important to be limited to a topic superficially covered in a social studies course. The future of industrial arts as a fully-recognized school subject ultimately depends upon its success in imparting this knowledge. But how adequately does our present methodology accomplish this?

Project Experience

In the industrial arts laboratory the productive processes of industry are studied through the planning and construction of projects. It is generally accepted that through project construction the student may be expected to have at least a limited experience with:

1. Methods of production by organizing a project on the mass production principle.
2. Materials of industry by actually working with them in their various forms.
3. Methods of fabrication through planning and construction.
4. Types of occupations by working in the various areas.
5. Safe working conditions and practices while engaged in potentially hazardous operations.
6. The development of some industrial skills through realistic practice.
7. Social relationships and the need for co-operation through the personal organization of the laboratory.
8. The need for good construction and design.
9. Activities suitable for leisure time.
10. A feeling of importance and satisfaction by successfully completing a project.

Shortcomings Viewed

This somewhat abbreviated list of experiences is quite impressive. However, before the degree of emphasis to be placed upon the project-centered course of study can be intelligently considered, its possible shortcomings must be viewed. Through project construction the student *cannot* be expected to experience:

1. The actual industrial production line techniques employed in this age of automation.
2. The wide variety of materials, old and new, used in industry.
3. Modern methods of fabrication that cannot be utilized due to limited facilities.
4. All forms and levels of occupations found in industry.
5. The best possible construction and design for every project due to the limited fabrication processes and materials available.
6. Realistic organization of industry, e.g., functions of boards of directors, stockholders, corporation presidents, business managers, etc.

In itself the project cannot adequately illustrate the extent of modern technology and industrial organization nor their effects upon our way of life. It should be constantly emphasized that the project is not an end in itself, but only a means of making abstract technical knowledge more meaningful to the student. The project-centered curriculum may be compared to a chemistry course in which the students spend 90 per cent of the class time experimenting with the making of soap, hydrogen, or invisible ink without the understanding of basic theory. A chemistry set is not a substitute for the school subject, neither is project construction equivalent to the study of industry. Therefore, it becomes evident that additional teaching techniques must be employed.

Additional Techniques

Guided tours through manufacturing concerns, if they clearly exemplify subject material being studied, are extremely valuable in affording the students an opportunity to witness actual mechanical operations and plant organization. When this type of experience is impractical, motion pictures portraying the extent of the productive capacity of American industry may be utilized to replace or supplement actual visitation.

Representatives from various divisions of labor and fields of industry may be invited to class as guest speakers. Their presentations create interest and give authentication to the course of study.

Certain fundamental understandings of our technological society can only be imparted by the development of relatively abstract concepts. It is equally necessary for industrial arts to effectively verbalize certain areas of its subject matter using the traditional classroom presentation as it is for the other academic subjects to utilize this method.

There can be little doubt as to the validity of the project-approach in industrial arts. It provides strong motivation for the pupil and possesses considerable learning potential in the opportunity it affords for experimentation. The great danger, however, is that the educational objectives will fade into the background and the physical activity will become thought of as being important in itself. If industrial arts departments choose not to emphasize the industrial aspect of the course material applicable to general education eventually the subject will be found in that limbo inhabited by those required subjects of yesteryear: rhetoric, Latin, and Greek.

Mr. Gardner is an instructor of industrial arts, State University of New York at Oswego.

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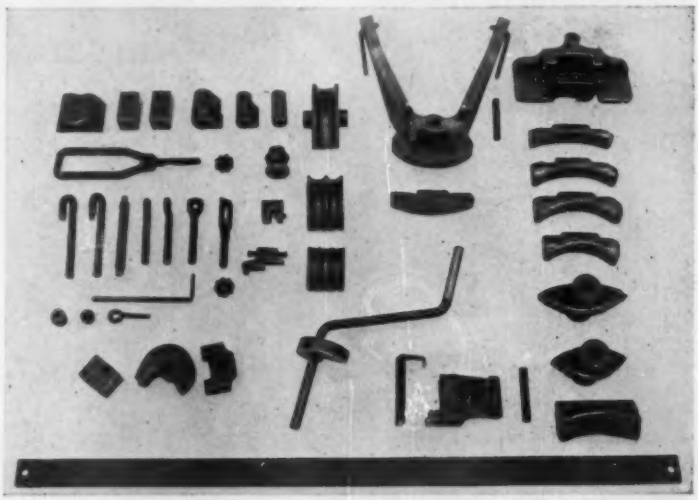

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TRENDS IN TRADE AND INDUSTRIAL EDUCATION

Increased enrollment, more instruction in academic subjects, greater financial support: these are among the trends in trade and industrial education as revealed by the "Digest of Annual Reports of State Boards for Vocational Education to the Office of Education, Division of Vocational Education," for the fiscal year ending June 30, 1959.

Progress in industry has diminished the demand for unskilled workers, and machine operators are being replaced by automatic machines. On the other hand, there is an increasing need for maintenance mechanics with great technical skill and knowledge whose range of intensity is necessarily increasing. These factors demand changes in school curriculum.

As industry shifts to rural areas, there is a need for new training facilities, both preparatory and extension. Community surveys more and more are serving as the basis and guide for the development of local programs.

The report showed that citizens are becoming more aware of the need for training and more willing to give financial support, as are state legislators. In most states there has been increased co-operation from labor and management and state agencies.

There is, however, a continuing shortage of qualified people on state and local supervisory staffs. Many states have developed plans for leadership development programs, based on the Annual National Leadership Development Conferences sponsored by the Trade and Industrial Education Branch.

In 1959, day trade comprised 30 per cent of the total training and industrial education classes. The greatest increase came in area vocational schools and junior and community colleges.

The female enrollment is now 17.5 per cent of the total in day trade classes. There is an increased number of women in programs previously exclusive, such as commercial art, drafting, and printing.

In general, programs were revised to include more extensive instruction in math, science, related technology, human relations, and communications. Training and industry educators met frequently with guidance personnel to provide materials for counseling with students and better selection of students. Rising graduation requirements (with emphasis on math, science, and foreign languages) affected enrollment in day trade classes. Expansion of preparatory programs in some states has been curtailed by over-crowded facilities and lack of funds and competent instructors.

The placement of graduates has been very good. It often is better from post-high than from high school programs.

There was a slight decrease in enrollment in co-operative training programs last year, but they are still important in providing preparatory training in areas where there are not enough students enrolled, finances for sufficient facilities, or employment opportunities to permit day trade shops.

In the extension training area, a variety of short-unit courses have been established to meet the specific needs of employed skilled workers. Instruction in new skills and technology are needed to meet current industrial employment requirements. The skill of apprentice-training graduates has created competition for journeymen, who then turn to extension programs. Although 1959 saw a slight decrease, extension training still comprises more than half the total enrollment in training and industrial education. There was a substantial increase in enrollment, especially female, in supervisory training programs.

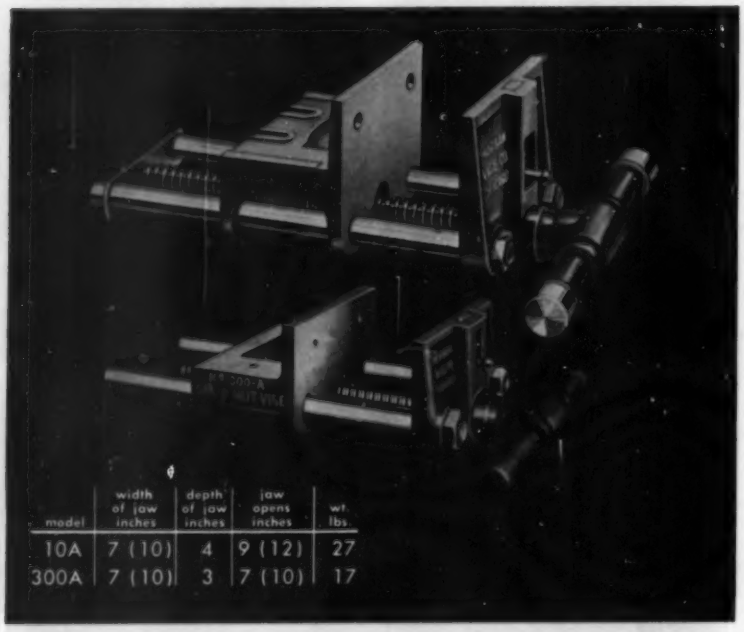
The number in apprentice training decreased slightly in 1959. Pretesting has been utilized in many states as a method for selecting students. Development of related instruction outlines for the major apprenticeable trades has progressed.

Many states have been broadening their teacher-training services for training and industrial education. There is a trend toward raising the certification requirements for beginners and requiring teachers to get a collegiate degree. An increasing problem is the lack of qualified persons in teacher-training positions, and there is a growing demand for teacher-training service provided by local superintendents and directors.

A National Professional Curriculum Materials Development Committee was organized as a consultant to the U. S. Trade and Industrial Education Branch and to various states. Improvement resulted in the curriculum-materials area when each state appointed a liaison person for information on curriculum materials.

Total expenditure for vocational trade and industry classes in 1959 breaks down as follows: local ($38 million) and state ($24 million), $62 million; federal, $11.5 million; total, $73.5 million. — *A. J. C.*

TWINS IN DESIGN.... TOPS IN EASE....



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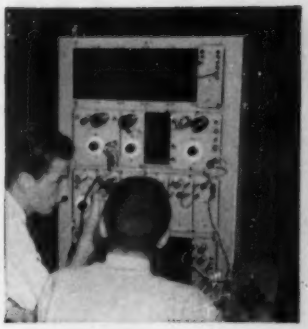

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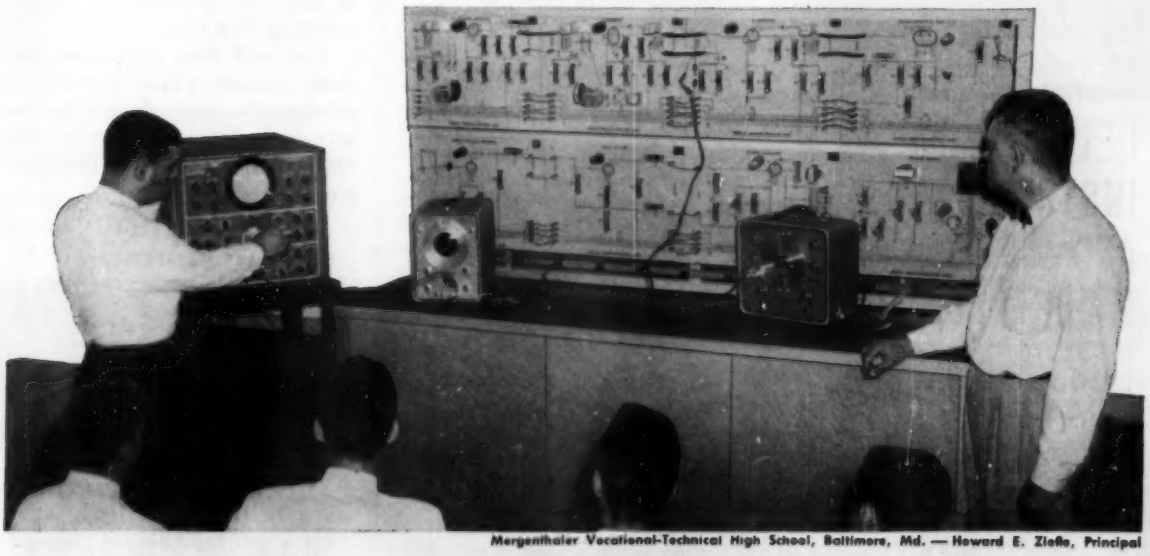

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Be Design Conscious

Helping youth acquire the industrial skills of our times is achieved substantially through the project selection method. This choice may result from examining popular periodicals, books, copying a similar project displayed in the shop, or a piece of furniture in some store. Under such conditions a student is duplicating the works of others (and possibly at the same time their errors). Within the limited time students have in our shops, all their projects should envolve the process of creating "good design."

Because a project is from the past, instructors should not forget that the element of design must not be forgotten; the authenticity of the design of antiques must be challenged. Before making such a piece of furniture, a student should do some research to obtain the purest form of that period of furniture. In this manner a student is "design conscious."

Many of our industrial arts projects may be listed under the heading of "brick-a-brack." Instructors permit students to copy plans of projects that are a conglomeration of various periods of furniture. Regardless of what design a student selects for his furniture, it should be a good example of that period and not a nameless object.

For those instructors and students interested in contemporary furniture, the possibilities are limitless. The design of today is directed towards the expression of the power, speed, and precision of the age. Originality is an important factor in contemporary design that is lost when one reproduces furniture of some famous designer of the past. These designers of the past were men ahead of their times and students should be permitted to experience the fascination of designing furniture.

It is amazing how original students are if encouraged to create their own projects.

After consideration of what they want to make, where it is to be used, and what mediums and techniques will be envolved, they can imprint their own signature of originality and craftsmanship upon a piece of furniture. This experimentation permits them to use different mediums, techniques, skills, and designs, which in turn contributes to their development as a thinking individual.

Mr. DeFourny is an instructor of industrial arts at the Dominion Junior High School in Columbus, Ohio.

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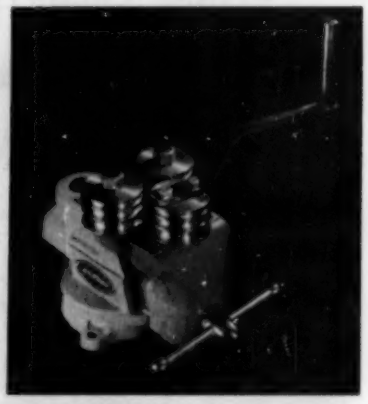

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Industrial Arts Project Evaluation

Although each industrial arts teacher strives to set up or evolve his own particular grading system, it is often helpful and enlightening to see the system and criteria that other teachers use. It is with this in mind that these grading scales are presented here.

The scales are for high school metal shop classes. Through experimentation the author found that one scale could not be used to grade all projects and still do a valid job of evaluation each time. A discrepency soon developed between projects that tended toward art as opposed to projects such as tools. Hence the two scales; each is used where it applies. For example, a project such as a hammer would be evaluated according to scale "A" whereas a project such as a bowl formed on a sand bag would be evaluated according to scale "B."

The scores are set up on a 50 point basis with the raw score divided by 10 to scale it down to A, B, C, D, F. The point divisions are as follows: A — 5.0–4.6; B — 4.5–4.0; C — 3.9–2.8; D — 2.7–1.8; and F — 1.7–0.0.

PROJECT GRADING SHEET

Name .....

Date: started..... finished.....

Name or description of project:

* * *

Grading scale A:

Drawing (3)	.....
Bill of material (3)	.....
Procedure sheet (3)	.....
Solving own problems when possible (8)	.....
Accuracy (11)	.....
Workmanship (11)	.....
Appearance	.....
Raw score	.....
Grade	.....

Grading scale B:

Plans (4)	.....
Solving own problems when possible (6)	.....
Workmanship (20)	.....
Appearance (20) (overall eye appeal)	.....
Raw score	.....
Grade	.....

— Richard N. Wahlstrom
Sweet Home, Ore.

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FUTURE OF THE PROJECT

(Continued from page 26)

"built in" flexibility which makes it possible for each pupil to "find" himself without being conspicuous in performing unrelated tasks. The unit also lends itself to activities of the service industries, which are not primarily concerned with construction-type products. Within such units, problem-solving activities are fraught with experiences which can be resolved through methodical investigation and research rather than trial and error.

The nature of the unit permits of not only individual but group and class projects as well. The line production project, carried on in its totality, is an excellent example of the latter. In all instances, however, the activities or projects selected have one common goal; namely, accomplishing the purposes of the unit. Project selection includes procedures not too unlike those used by industry, adapted of course, to the limitations of time and pupil maturity. The principles of design which involve the pupils in selection of materials based upon function as well as aesthetic appeal; the intricacies of processing these materials into finished products; the opportunities for creative expression and even invention, all within the framework of the unit can make industrial arts a vital area of the school curriculum.

True, there are a few disadvantages in unitary teaching as there are in all the others, but the advantages not only to the pupil but to the instructor should be apparent. It is also true that any method is as good as the teacher using it. Unitary teaching is not for the teacher who believes in the status quo; who is concerned with how many projects leave his shop; or who dares not to explore the unknown. Rather, it is for the teacher who believes in our industrial heritage and future and makes every effort to help the youth who attend his classes understand and appreciate it as well.

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product development, mass production, etc.

"What is industrial arts?" The writer has inquired of many both inside and outside of our field. "It is making projects," has been the response from both sources; perhaps with greater emphasis and finality from some of those in our field.

When queried further it was learned that the typical concept generally consisted of: the pupils making something they wanted; copy work being frequently involved or plans being supplied outright by the teacher; individual student effort being made only on the article; and the complete project being very likely to be some piece of wooden household furniture duplicating something already in the pupil's home.

It seems that industrial arts has become so engrossed in "the thing" that, if pressed on the defensive, which is not too remote a possibility, it would have a pretty weak case, educationally speaking. In many cases, is industrial arts offering any richer experiences than are being provided by hobby programs in home basements or fellowship halls of churches? Is there more to industrial arts than the leisure time, recreational, hobby, or do-it-yourself aspects? Can an approach be made to attain other significant and challenging objectives through project selection, planning, constructing, and evaluating?

Industrial arts also has as one of its objectives: to develop in each pupil an interest in and an understand-

(Continued on page 62)

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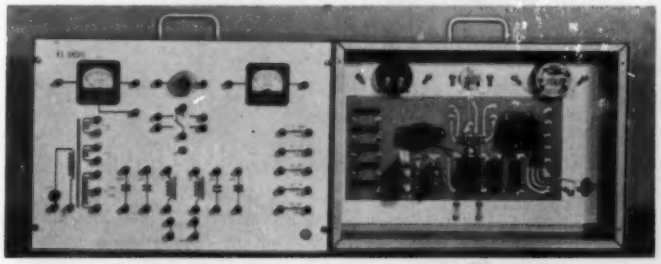

THE A. C. CIRCUITS PANEL (front and rear view) is a typical unit. It offers a thorough investigation of the principles of a-c circuits through prepared experiments covering resistors, inductors and capacitors in a-c circuits, series and parallel a-c circuits, power factor in a-c circuits, transformers and auto-transformers, series and parallel resonance, coils and capacitors in a-c circuits, and wattmeters in a-c circuits.

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FUTURE OF THE PROJECT

(Continued from page 60)

ing of those phases of industry dealing with product development and production. Industry frequently has a product development team. In an industrial arts class why not designate one or more teams consisting of two to four pupils to select and design some articles to be made?

Since modern industry is characterized by mass production, why not have the class select and produce at least one of the team-designed articles on a production basis? Why not visit a local industry, or study a good film on modern industry?

This will mean more work for the teacher than to go along from day to day, individually tailor-making the traditional. Maybe we need to get fired up about doing something different.

Perhaps an approach something like this will help us appreciate "project" as a challenging method as set forth by Dewey and Kilpatrick. Our understanding of the "project" in industrial arts, representing "a student-made thing," has probably contributed to our growing traditional and a bit sluggish.

Why not have our industrial arts pupils drink from a running stream rather than a stagnant pool? ◀

Wright:
more effort toward the factors deemed essential and characteristic of an educational project

Industrial arts commands a unique position in our educational program, in that it provides activity . . . activity that is specific, concrete, and measurable. It provides the type of activity that capitalizes on sincere interest in the job at hand, the sort of interest for which other subject matter areas are constantly striving. To de-emphasize the project would be nothing more than going against a rich and most important heritage. When and if we do place less emphasis on the project, industrial arts will be nothing more than another academic course, and we will very definitely be striving for recognition as well as survival. The place and function of the project in industrial arts are most important. By means

(Concluded on page 64)

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Principal at the new Brighton District No. 1 Council Rock Elementary School, Rochester, New York, selected by A.A.S.A. for its exhibit of outstanding school designs:

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"Our reward is evidenced in the picture above. Good attentiveness, and — later — good recall of what they saw and heard."

The picture above was taken using only that light reflecting from the screen while a movie was in progress. The projector that throws such a brilliant easy-to-see image on the screen is a Kodak Pageant Sound Projector, with its special Kodak Super 40 Shutter. With this shutter, the Kodak Pageant actually projects 40% more light onto the screen than projectors with ordinary shutters.

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FUTURE OF THE PROJECT

(Concluded from page 62)

of it, industrial arts can and does offer students educational experiences that are most important, distinct, and significant.

Quite often, in fact, too often, during the past two or three years (ever since "Sputnik"), a contrasting belief has been expressed by some of our leaders. They say we must de-emphasize manipulative activities . . . *project work* . . . and place more time and effort on related math, science, and the like. Why must we *now* justify industrial arts on the basis of what it can and does contribute to math and science. The very thing that brought industrial arts into being, that made it unique and vital in our educational program as well as appealing to students, has been and will continue to be, well designed and skillfully constructed projects. Such men of industry as Knudsen, Kettering, and others, as well as Struck, Coover and many other leaders in the field of industrial arts, are of the opinion the sort of activities industrial arts affords is a most important and essential educational experience. This idea is further strengthened by the industrial arts awards sponsored by Ford Motor Company each year. Perhaps we should spend more time on the concept of what math and science can contribute to the complete and truly significant "industrial arts project." Industrial arts is quite capable of standing on its own merits and can be justified in our schools on the basis of its own educational content.

The project very definitely should not be de-emphasized, but more effort must be placed upon the factors deemed essential and characteristic of an educational project. As of now it behooves all industrial arts teachers to take full advantage of every opportunity for educational growth offered by the project. Maximum effort must be put forth to realize problem solving experiences.

In addition to these essential factors the future role of the project in industrial arts and thereby . . . the future of industrial arts, will be in direct proportion to the opportunities the project affords such student experiences as:

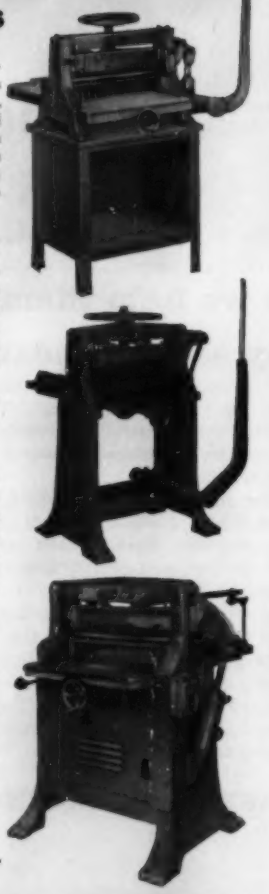
1. Planning, plans of procedure, for the individual and for group activity.
2. Judging results of self and others in a careful and constructive manner.
3. Educational content, the how, why, when, and where of things.
4. Purposeful activity, pupil reasoning, not completely teacher directed.
5. Doing, growth through activity, knowing and appreciating what constitutes a job well done.

Yes, the *project* is most important, but we should not lose sight of the fact our students must *"know"* as well as be able to *"do."* They must leave the industrial arts laboratory with "something under their hat as well as something under their arm." This concept cannot be overemphasized; therefore, all industrial arts teachers should take full advantage of every opportunity provided by the *project* to put across all the technical and related information possible. We must ever be cognizant of the fact the *project* is a means to an end and not an end in itself. By definition industrial arts is not only an activity program, but also a study of those phases of industry that have become an important part of our social culture.

TEACH THE

Basic Principles of Paper Cutting

with C & P CUTTERS



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Chandler & Price Paper Cutters are engineered to meet all the requirements for safe operation by students and have been standard equipment in schools for many years. If you have an out-dated or unsafe cutter in your school shop or are planning the purchase of a new one, your first consideration should be a school-approved C & P Cutter.

19½" and 23" Bench Model Lever Paper Cutters

Here is a small size lever paper cutter particularly suited to school shops where accurate cutting is required but where sizes of jobs do not require a larger cutter. A simple, two-handed safety lock removes practically all chance of injury to operator. Knife cannot fall accidentally nor cutting handle be pulled down until safety lock is held open by operator's left hand at the start of each cut.

Designed for mounting on bench or cabinet, this cutter may be purchased with or without the stand shown in the photograph.

Craftsman 26½" Lever Paper Cutter

The many exclusive features of this cutter make it the most popular cutter for school use. A two-handed safety lock prevents operation of the cutter until safety lock is held open by operator's left hand. The compound leverage action of the knife pull down makes cutting easier. A counter-weight balances the knife bar. A double-grip safety control which requires the use of both hands during the cutting cycle is available as extra equipment.

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This new Hotpack Electric Furnace is fast heating; built for continuous use from 300° F. to 2000° F. It is the only furnace equipped with Automatic Controlling Indicating Pyrometer and also with Limistat control in this price field.

SPECIFICATIONS

Model	Interior Size W.D.H.	Current Characteristics	Prices F.O.B. Phila.
7076	8"x 8"x 5½"	110 V AC 15 Amp.	$265.00
7074	8"x 8"x11"	115 V AC 15 Amp.	295.00
7073	12"x12"x11"	230 V AC 23 Amp.	430.00
7077	15"x16"x16½"	230 V AC 30 Amp.	640.00
7099	12"x12"x 5½"	115 V AC 15 Amp.	305.00

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For preheating Methyl Methacrylate in sheet or rod form where it is necessary to maintain even temperature throughout the sheet especially desirable in compressed air, vacuum, or pressure forming techniques.

The Oven is controlled by a newly developed thermostatic control, sealed in and conveniently placed on the front panel of the Oven. It can accurately be set at any desired temperature where a quick rate of heat up to 306° F. is desired.

Due to the Aluminum Construction, the Oven is very light in weight and can be carried from the room or project to project. As it operates on 110 volt AC or DC, it can be plugged into any 110 volt receptacle.

SPECIFICATIONS

Model	Interior Size	Wattage 110 AC-DC	F.O.B. Phila. Price
600	12"Wx12"Dx12"H	700	$ 90.00
602	24"Wx12"Dx12"H	1400	145.00

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Large chamber: 12" wide, 11" deep, 9" high

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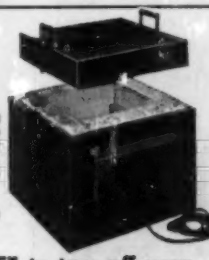

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Plug-in type, 115 v., $14.95 Wire-in type, 220 v., $27.95

Hotpack ELECTRIC CERAMIC KILNS

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1. Eye level controls — pilot light. 2. Built-in pyrometer for visible accurate temperature indication. 3. Handles are cool to touch. 4. Control switch — low, medium, and high heat for even distribution. 5. Special insulation holds heat and prevents scorching of table top. 6. Maximum temperature 2050° F.

SPECIFICATIONS

Model No.	Interior Size	Shelves Furnished	Approx. Time	Price F.O.B. Phila.
7006	8"x 8"x 5½"	1	3 hrs.	$ 85.00
7004	8"x 8"x11"	2	4 hrs.	115.00
7005	12"x12"x11"	2	3 hrs.	250.00
7007	15"x16"x16½"	3	4 hrs.	480.00
7009	12"x12"x 5½"	1	4 hrs.	125.00

Enameling on copper can be efficiently fired on our models No. 7006 and 7009.

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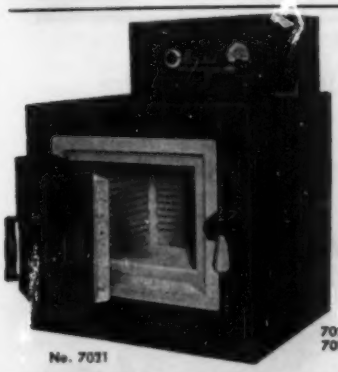


No. 7021

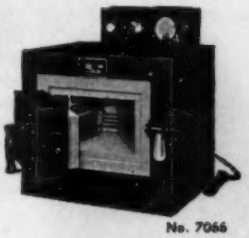
Temperature to 2350° F.

Fast come-up time: 5 hrs to 2300° F. 7" of insulation, including interlocked 2500° F. brick. Controls grouped in eye-level panel, recessed with special plexiglas cover to prevent unauthorized adjustment while in operation. Many other features.

SPECIFICATIONS

	Interior Size	Watts	Price F.O.B. Phila.
7021	10"x 9½"x 9"	2.8 KW	$ 225.00
7024	19"x18½"x18"	14 KW 230 volts	$1080.00

CONTR. TEMP. KILN FOR ENAMELING ON COPPER



No. 7066

These units provide manual adjustment of temperature for kilns. They may be regulated so that the current may be supplied to the kiln for any percentage of time per minute. This method of selection provides exact temperature because the slightest movement of the control knob will vary the time of input, thereby raising or lowering the temperature as desired.

SPECIFICATIONS

Model	Interior Size	Price F.O.B. Phila.
7069	12"x12"x5½"	$188.00
7066	8"x 8"x5½"	144.00

NEW IMPROVED METAL ENAMELING KILN

No. 7032

Fast come-up time, 60 minutes to 1500° F. Uniform heating from floor refractory; high grade coiled heating elements. Unique front door opening prevents heat loss, eliminating possibility of dangerous accidents. Many other features.

SPECIFICATIONS

Model	Interior Size	Watts
7032	5½"x 6"x5"	115 V 10 Amp. Price F.O.B. Phila., $45.00
7033	11"x12"x5"	115 V 17 Amp. $85.00
7034	11"x18"x5"	230 V 12 Amp. $135.00

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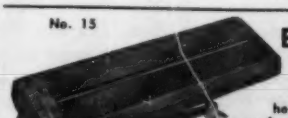
ELECTRIC PLASTIHEETER

No. 15



Designed for use in Plastic Courses in the school — a commercial type of strip heater designed to heat sheets of Plexiglas or Lucite until they become soft and pliable for shaping to the form desired. It is essentially used for straight line bends or folds and is capable of heating sheet material up to ⅛" thickness in from 30 seconds to 4 minutes depending on the thickness of the contact with the heating element and the platen remains cool, there is no possibility of creating mark-off on the sheet.

SPECIFICATIONS

No.	Working Space	Overall Size	Wattage 115 Volt	Shipping Weight	F.O.B. Phila.
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"Your 'Working with Light' packet offers much more in the area of science of lighting than the ordinary project book used in shops. I'm happy to see more of this 'why' and 'how' scientific approach."

This comment from a shop teacher is typical of the high praise accorded the supplementary classroom program distributed by the Better Light Better Sight Bureau. Last year, 30,000 teachers sent for this comprehensive program. It presents the intriguing subject of Light and Sight in a manner designed to heighten student interest and lighten teaching work. Moreover, the Bureau's aids are thoroughly up-to-date, in contrast to standard textbooks which are not normally able to keep abreast of rapid developments in this specialized field.

NEW KITS READY NOW

The Bureau's supplementary teaching program, "Working with Light", has been prepared after consultation with representatives of the N.E.A., the A.I.A.A., the A.V.A. and others prominent in industrial arts and vocational education. It is specifically formulated for high school and junior high school industrial arts classes, and includes a 116-page lighting handbook, 24 project leaflets and a reference folder for each of 24 students.

FREE FOR THE ASKING

A complete package of "Working with Light" materials will be sent *without cost or obligation* to shop teachers in areas served by a Better Light Better Sight Bureau utility sponsor. (We will check our sponsor list for your area.) For your free kit, use the readers' service card in this magazine... or simply send your own name, and your school's name and address, to: BETTER LIGHT BETTER SIGHT BUREAU, Dept. WWL-4, P.O. Box 1647, Grand Central Station, New York 17, N.Y. *(Offer not available to students nor to subscribers outside the U.S.A.)*

PROJECT SELECTION

(Continued from page 31)

that little time can be afforded to learning processes that have already been experienced by the pupils. If we are attempting to achieve the exploratory aspect of industrial arts, then I think we will all agree that new learning experiences should be included in all projects selected.

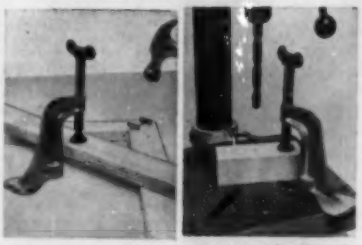
8. Pupil Interest and Needs

Many of us have attempted to select projects for our courses because they contain a certain number of operations or learning units. We fail to consider the pupil and his interests and needs. We attempt to teach subject matter rather than youth. We attempt to cover a certain number of operations or a certain amount of material each year, whether our pupils learn it or not. What the pupils are interested in at age 12 is not what we as mature individuals would be interested in, yet we try to force adult interests on immature pupils. Most projects will interest pupils in one of two ways, either it is something that he needs or wants and can use immediately or it is a project which can be used by some member of his family or a friend. These can be given as gifts for which praise will be received. We must consider interest if we are to develop the greatest potential of our pupils. We should make an attempt to discover what the interests of our pupils are concerning project selection. Many of you are probably saying to yourselves that it won't work, boys don't know what they want to make or do. Have you tried to find out? Have you given them an opportunity to select their own project?

The greatest difficulty that we encounter is our inability to place ourselves in the position of the pupils and interpret their thoughts, ideas, and interests. If we do this, we will find greater success in project selection. It's not simply saying "What do you want to make today?" rather it requires a carefully prepared plan to discover these interests and needs and to provide for project selection based on an understanding of the adolescent, his growth and development. It's work. But all teaching is work and many discipline problems will be eliminated and interest in your program will grow rapidly when the pupils' interests and needs are considered.

"Jorgensen"

HOLD-DOWN CLAMPS*



mount wherever needed — on any work surface — drill press, wood or metal table

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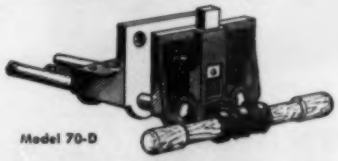

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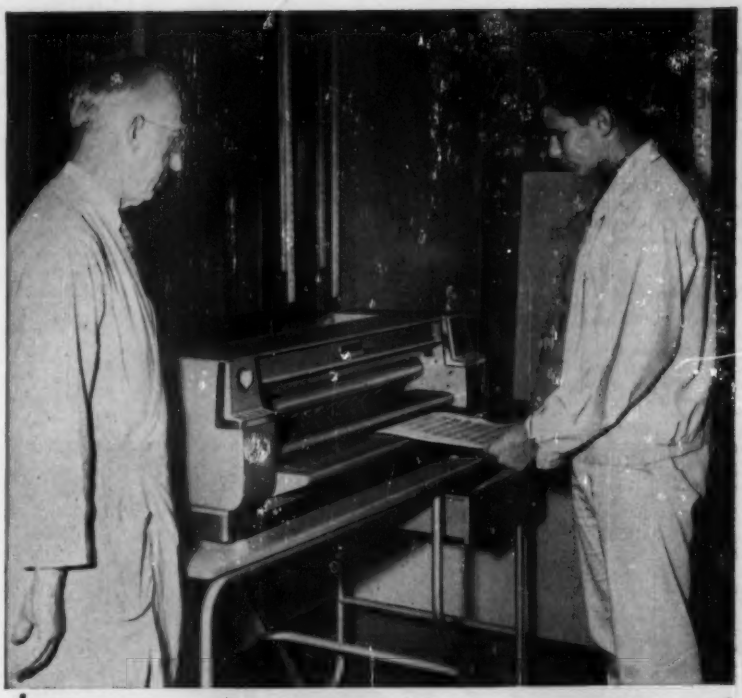
9. Objectives of the Course

Probably this is the most neglected criteria in project selection. We list a set of objectives that appeal to our principals and superintendents. They look good on paper, but what are we doing to achieve them? If we accept the objectives of industrial arts as stated by the Industrial Arts Policy Commission of the American Vocational Association as our course objectives or if we set up a list of our own, we must organize our courses to fulfill them. Too many of us are guilty of listing nine or ten objectives and of only achieving one or two. Each project that we select for use in our courses should contribute toward at least one major objective of our course. This should be the first test of all projects. No matter how good the project may appear to be or how many other criteria it meets, if it cannot stand the question "Does it help attain the objectives of my course?" it should not be used in our shops. The objectives are our aims or goals. We have a purpose in everything that we do. In our shops, that purpose should be the attainment of the objectives of our course.

What are the implications of these criteria to us? Criteria must be considered in all phases of project selection if we are to achieve our course objectives. If you assign the project to be made by the pupil, it is your responsibility to see that these criteria are considered when selecting the project you assign. If you provide for free choice of project by the pupils, then the criteria for project selection should be considered in teacher-pupil consultation. If you provide a guided choice situation where pupils select one project from a group, then you must consider this criteria in selecting the projects for the group.

In all methods, the pupil must be taught how to select and plan a project. Many projects of little educational value are constructed in our shops because pupils don't know how to select a project or what to consider when selecting it. We must teach project selection just as we teach any other aspect of our courses.

No one project will include all of the criteria listed, but the more nearly it comes to meeting those, the better the project it is likely to be and the more nearly we will attain the objective of our course. ◀



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notebook

ON MODERN COATED ABRASIVES

An abrasive* is any hard, sharp material which can wear away a less resistant surface. This term embraces sharpening stones, grinding wheels and the great variety of coated abrasives, often incorrectly called sandpaper.

Two Abrasives

Abrasives fall into two convenient classifications: natural and electric furnace. The natural abrasives are flint, garnet and emery. The two most common electric furnace abrasives are silicon carbide and aluminum oxide.

Flint or flint quartz is found in many parts of this country but not all types are suitable for abrasive purposes. For example, gray flint used by the early American Indians for arrow and spear heads, is an unsatisfactory abrasive. The best types range from a dull grayish-white to faint pink and are mined from open pits in New Hampshire and Maryland. Flint lacks the hardness and durability of other abrasives. It is sold in sheets or handy packages primarily for the use of home owners and hobbyists. Garnet crystals are much sharper and harder. This mineral belongs to the gem family but has little such value because of flaws. It is, however, an excellent abrasive.

Only two of the seven known forms of garnet have been used to any extent for coated abrasives. The best, called Almandite, comes from the Adirondack Mountains.

Garnet crystals found imbedded in surrounding minerals are useless as abrasives. Garnet is obtained in a process similar to gold-panning. After the ore is blasted from the mountain side, it is crushed and passed over a series of vibrating "jigs" operated in water. The heavier garnet settles down. The ore is only about six per cent garnet which means that whole mountains must be removed and sorted out. When received at the manufacturing plant a piece of garnet is about the size of a bean.

Abrasives are measured for hardness on the Moh scale. Diamonds have the highest possible rating of ten. Garnet is fairly hard; it ranges from 6.5 to 7.5. It also has a certain toughness which prevents the crystals from breaking down too quickly. As an abrasive it is far superior to flint.

Emery has been mined for centuries in Turkey and Greece. It is a black mineral, essentially a mixture of iron oxide (40 per cent) and corundum (60 per cent). This corundum is a natural aluminum oxide and forms the abrasive action of emery. Although iron oxide detracts from the efficiency of emery as an abrasive, it adds to its polishing action. With a roundish grain shape, the cutting action of emery is very slight, but it has great polishing potential.

Silicon carbide is an artificial abrasive first made in 1891. This material was discovered in an attempt to make artificial diamonds. When a mixture of silicon (sand) and carbon was heated in a miniature electric furnace, the experimenters succeeded in fusing a minute portion, producing a few exceedingly sharp beautiful blue crystals hard enough for the polishing of diamonds and gems.

In the present manufacturing process of silicon carbide, the two primary ingredients are coke, which supplies the carbon, and sand containing silicon. This mixture of sand and coke is built up around a large electrode running the full length of the furnace and then walled up with uncemented fire brick. A small amount of saw dust added to the mixture reduces inflammable gases and makes the mixture porous.

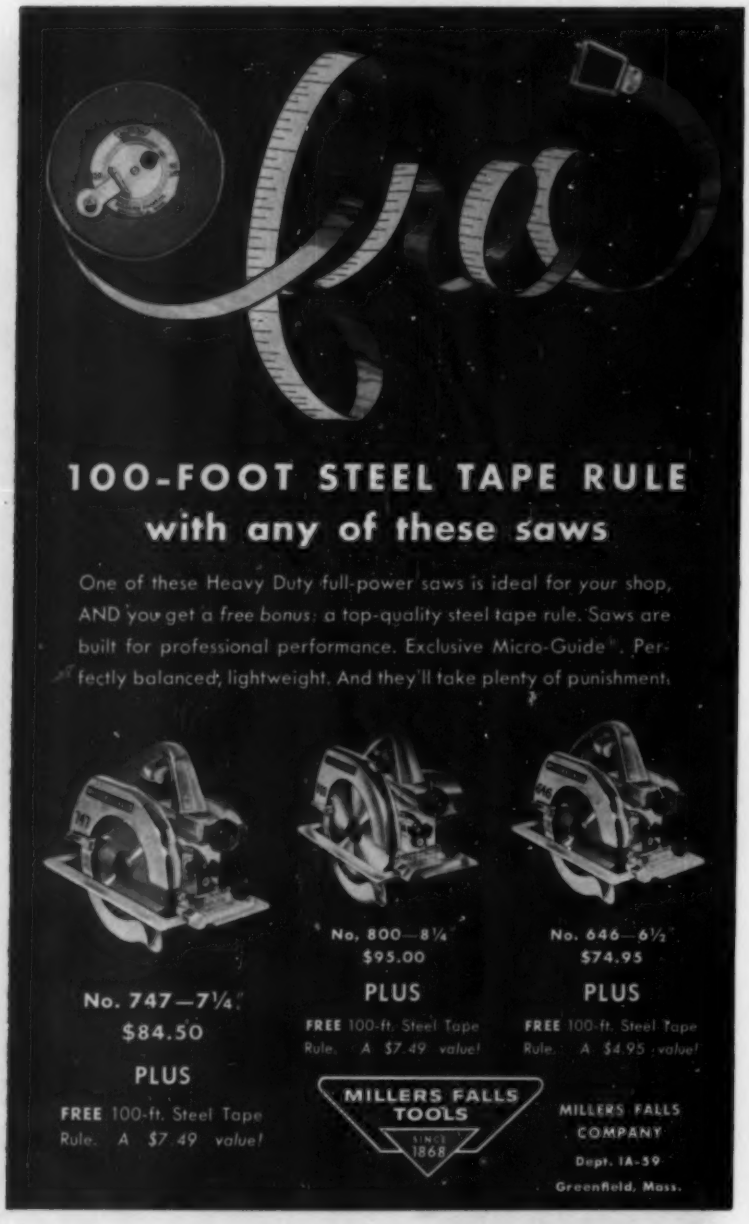
When the furnace is ready for firing, the electric current (6000 amperes) is turned on, which surges through the electrode for 36 hours. Reaching 5000 deg. F. the heat affects the formation of silicon carbide. Cooled for a day, the firebricks are removed and the outer crust of the furnace mixture torn out. The core of crystals is exposed and then removed. Each furnace "run" produces a "pig" of crude abrasive weighing several tons.

Silicon carbide is extremely hard and sharp. It is rated at 9.5 to 9.9 on the Moh scale, but is more brittle than aluminum oxide, which limits its usefulness.

Aluminum oxide is made from a raw material called bauxite, a claylike substance (which also produces metallic aluminum and alum) found near the surface of the earth. During the process of manu-

(Continued on page 70)

*Adapted from *Principles of Woodworking*, Holtrop and Hjorth, The Bruce Publishing Co., Milwaukee, Wis., in preparation.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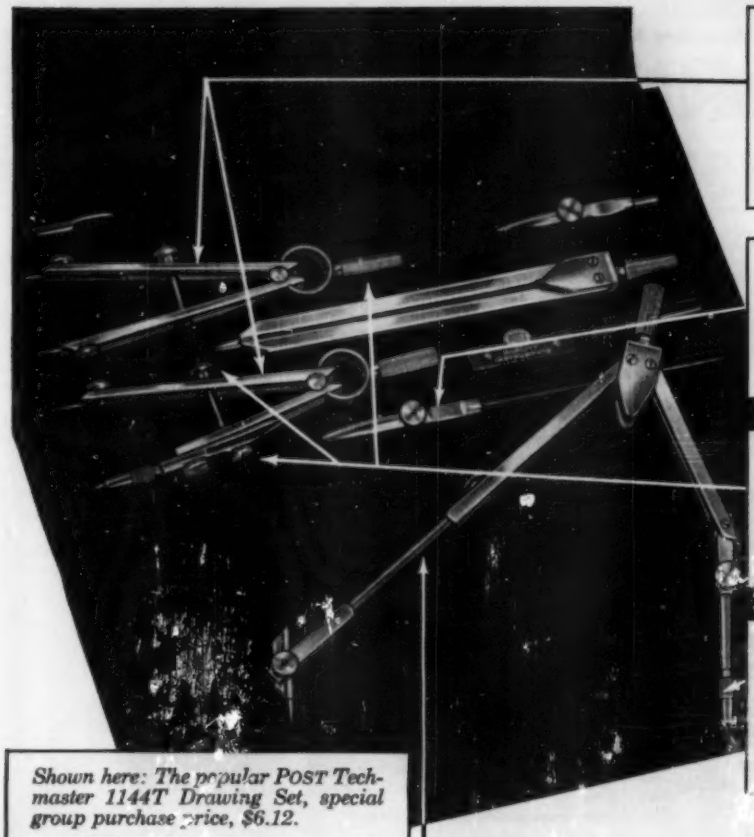

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POST

COATED ABRASIVES

(Continued from page 68)

facturing aluminum oxide, bauxite is mixed with some coke and iron filings which act as reducing and purifying agents. This mixture is loaded into an electric furnace and heated to approximately 3500 deg. F. As more bauxite is added, large "pig" is formed, the center of which yields about 50 per cent aluminum oxide. After proper cooling, this "pig" is removed and broken into lumps for easier handling. Aluminum oxide as an abrasive differs from silicon carbide. Although not quite as hard and sharp, this reddish brown mineral has a remarkable toughness. It markets under such trade names as Alundum, Adolox, and Metalite.

Abrasaive Backing

Abrasives are coated on several kinds and grades of backing. The three most common paper backings are: rope, made from old rope, which has the strongest fiber of all paper backings and will withstand a severe strain; kraft, made from wood pulp and used where the strength of rope paper is not needed; and jute made from the jute plant and used as a backing for pouncing paper, that extremely fine abrasive used on felt hats.

Special apparatus has been developed to test paper for bursting strength, ply adhesion, folding qualities, density of fibers, tensile strength, stretch, tear resistance, surface finish, porosity, and uniformity of thickness.

Cloth backings are used when more strength or flexibility is needed. The two grades of cloth generally used are *jeans and drills*. Both are of a special diagonal weave in which the lengthwise threads are stronger than those in the crosswise direction. This is especially desirable in endless belts, as it insures against sideway tearing and provides for greater resistance to stretch. Jeans is lighter than drills and not as strong, but it is more flexible.

Adhesives

Sometimes cloth and paper are used in combination. With coated abrasives, two types of adhesives are used primarily: *hide glue* and *synthetic resins*. For most dry sanding, hide glue is well suited, but where sanding is done with water, the adhesive must be waterproof. Synthetic resins have now been developed which meet this demand.

Hide glue must be of high quality and must pass a number of strict laboratory tests for grease content, viscosity, jelly, bacterial decomposition and foam test.

Synthetic resins were developed for those operations which require the use of water or generate intensive heat. They will not melt or soften, and they hold the abrasive grains firmly in place. Modified glues and resins were developed during the closing years of World War II. It was found that certain extenders to these glues improved their resistance to heat and water. Modified adhesives are noted for their exceptional grit anchorage, which results in longer coated abrasive life.

The Manufacturing Process

The manufacturing process of coated abrasives includes, primarily, the following steps: (1) crushing the abrasive material into suitable size, (2) preparing the cloth, (3) preparing the glue, (4) the actual making process, and (5) the finishing operations.

After arriving at the factory, the abrasive material, whether in lump or smaller form, is first crushed by way of powerful jaw and roll crushers into suitable sizes. This process yields grits from the very coarsest to very fine "flours." They are separated by passing the mixture over a series of vibrating screens of silk bolting cloth. These screens are hand made specially in Switzerland, where this art has been handed down from father to son for generations. The various screens are distinguished by numbers which correspond to the grit size of the finished product. For instance, a garnet grain No. ½ (or No. 60) mesh has passed through a screen having 60 openings to the linear inch. This same grain size would not go through the next screen, No. 80, having 80 openings to the linear inch in each direction. Neither must the No. 60 screening contain any of the next coarser grit, No. 50, which has been separated by another screen. The finest screen size is No. 220, which has, in addition to the silk strands, 48,400 openings per square inch.

The grading process for very fine particles cannot be done by screens. Sometimes these "flours" are graded by "sedimentation," in which the microscopic grains are classified according to the length of time they take to settle in water. Another method is "air flotation," in which the flour is blown by a fixed volume and speed of air. The size of the grain is determined by the distance it travels by air, the lightest flour being blown the farthest.

The cloth used as a backing must undergo a number of processes before it is ready for use. As it comes from the

(Concluded on page 72)

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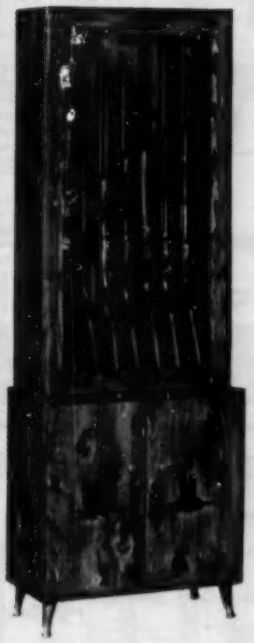
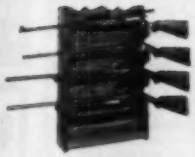


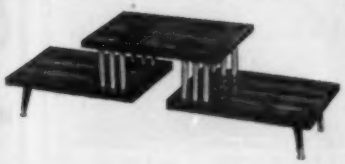
GUN CABINET NO. 707

The knotty pine "Pioneer" gun cabinet holds eight guns. Bottom storage compartments for ammunition and other equipment equipped with two locks. Brass ferrules on legs. Overall size 27" wide, 15½" deep, 83" high. Glass for door not included.



GUN RACK NO. 404

This four gun rack with full width drawer for ammunition and cleaning gear is all cedar. Comes complete, ready to assemble with all screws, brass pulls and safety lock. 32" high, 21½" wide.



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COATED ABRASIVES

(Concluded from page 70)

cotton mills the cloth is too porous and has too much stretch.

While the cloth is stretched it is also dyed the proper color. After drying, the pores of the cloth must be filled to prevent the glue coating from penetrating. Usually an inert material such as clay, starch, or talc is used with a mixture of glue.

Next, a thin coat of glue is applied to the cloth. This is known as the "sizing coat"; it will unite with the heavier glue coat that is applied later. When dry, the cloth is ready for the making machines.

When hide glues are used, since they are received dry and coarsely ground, they must be soaked in water and heated to the correct temperature.

With the abrasive grains graded, the adhesive in solution, and the backing ready, the next step is the actual making of the product. The backing is first spliced, one huge roll to another, so that stops will not be required once the "run" or "make" begins. The widths of backing vary from 27 to 50 inches. Then the backing is passed over rollers which imprint the trademark, brand name, grit, and serial number. The ink dries in two seconds to prevent smudging. Next the adhesive is applied by calendar rolls in carefully regulated amounts, varying in concentration and quantity with the size of the grains used. The abrasive grain is applied, either by a gravity method or electrostatically. Thus the amount of grain deposited is controlled with great accuracy and can be varied from a very thin "open coat" to a dense "closed coat."

Electro coating is one of the most momentous developments in the abrasive industry and has its origin in a simple physical experiment: rubbing a comb over one's sleeve, charging the comb and picking up bits of paper and holding them at right angles to it.

In this coating process, an electrostatic field is built up between the positive and the negative electrode. As the conveyer belt carries the grains between the electrodes, they are raised on end and then, like tiny arrows, fly toward the upper electrode, end first (they align themselves in the direction of the electrical flow). At the same time, all these particles separate themselves at equal distances since they carry like charges.

Then the product goes to the drying racks. It is carried to the sizing machine. There, while not completely dry, a second and light solution of glue is applied which unites with the still wet original bond and serves to anchor the grain securely. The goods are then carried by the same racking system to the final drying room. When dried, the material is wound into huge "jumbo" rolls of thousands of yards each from which are cut the various shapes of the finished product. The coatings on these large rolls vary, since each type will perform a specific job.

Just how do coated abrasives do their work? It is generally assumed that they remove stock in the form of dust, but actually each grain on the sheet is a cutting tool much like a chisel or plane iron. By regulating the amounts of abrasive material placed on the backing, the grades of coated abrasives are either *closed coated* or *open coated*. Closed coating means that the abrasive grains completely cover the surface of a backing. It is particularly useful where the abraded waste does not clog the spaces between individual grains.

The last step consists in converting the jumbo rolls into required sizes and shapes.

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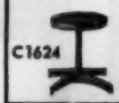

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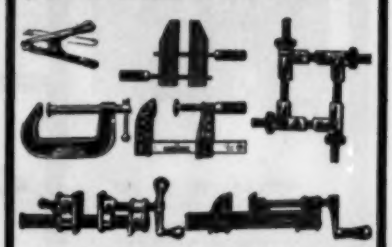

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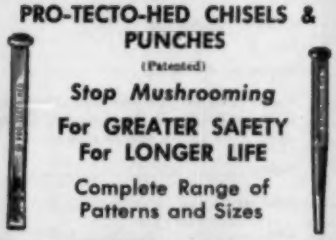

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NEWS

(Concluded from page 16)

Students do a great deal of the work. Painting, electrical work, and cabinetmaking in most of the programs were done entirely by them. Some of the larger-population group schools did not do as much, possibly because of strong unions and local building code laws.

The majority of all the homes built cost between $10–15,000. Four schools built at a price of $7–10,000 and five between $15–20,000; at least two houses exceeded this range. The average price range rises proportionately through the higher population groups.

An estimated 2072 students have completed the building trade program. This is not totally accurate, however, as some schools did not know the number of graduates from their program. The average overall percentage of students working in an area taught in the program is 42 per cent. In the first three population groups the percentage is 36 per cent, and 53 per cent in the top group.

personal

Appointments . . .

▸ *Paul W. De Vore* has been appointed director of the department of Industrial Arts at Oswego, N. Y., succeeding *Robert D. Helsby*, who resigned to become deputy commissioner for administration of the New York State Labor Department.

▸ *Edgar C. Godfrey*, assistant professor of industrial arts education at Georgia Southern College at Statesboro since 1949, is on an extended leave of absence while working toward his doctorate at the University of Maryland, College Park. He has served as an assistant to the Executive Dean for Student Life at Maryland during the past year and will continue in this capacity during the 1960–61 school year.

▸ *Dr. Walter C. Brown* is leaving his position as associate professor of industrial education at the University of Missouri, to take a position as the director of vocational-technical education and supervisor of industrial arts with the Phoenix, Ariz., Union High Schools and Phoenix College System. He has been a member of the University of Missouri teaching staff since September, 1949. Dr. Brown was president of the Missouri Adult Education Association in 1957, and in 1950–51 he was president of the Missouri Vocational Association.

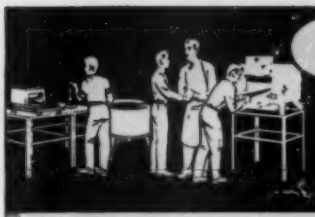
▸ Three vocational education staff members in the Georgia State Department of Education to assume new duties are:

Jack Nix as director of the division of vocational education, succeeding *George I. Martin; J. G. (Whitey) Bryant* as state supervisor of vocational agriculture, to succeed *T. G. Walters;* and *T. D. (Dick) Brown, Jr.*, as assistant vo-ag supervisor in charge of the northwest Georgia program, succeeding the retiring *Clarence M. Reed.*

▸ *Harold James Mc Whinnie*, shop instructor at the Laboratory School of the University of Chicago, will be in the West Indies for the coming year at Boys Secondary School, St. George's, Grenada.

retirements . . .

▸ *Dr. Clarence Baab*, professor of industrial arts at the Colorado State College, Greeley, since 1935, will retire at the end of the fall quarter. *Dr. Everett R. Glazener*, former director of the department of industrial education in Arkansas A. and M. College, has been named Dr. Baab's successor at Greeley.



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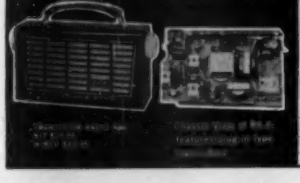

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FLEXIBLE DISPLAY SPACE

A frequent problem in the industrial education shop is the lack of convenient display space. This is solved in the sheet metal area of the Pueblo High School in Tucson, Ariz., by fastening an expanded metal sheet to the wall. Projects are hung up by small wire hooks. Easiest and most appealing arrangement of articles is by the "shot gun" technique of random placement. The accompanying photo shows how wall spacing difficulties were overcome by slanting the expanded sheet above the fire hose cabinet. Fastening was made by toggle bolts and lead anchors in the cement block wall.

Maurice F. Gupsill
Pueblo High School, Tucson, Ariz.

A TEACHING AID FOR BEGINNING PRINTING

Certainly one of the most important segments of the elementary hand composition course in printing is the information related to spacing. Presented properly, it forms the foundation for successful typesetting by the printing student. It is the absolute prerequisite of any high school printing course.

Methods of introducing the unit on spacing often vary. Some instructors utilize a diagram or chart showing the basic values and dimensions, while others resort to tables giving percentages and their relationships. All the above mentioned techniques are valid and I have used them with varying degrees of success.

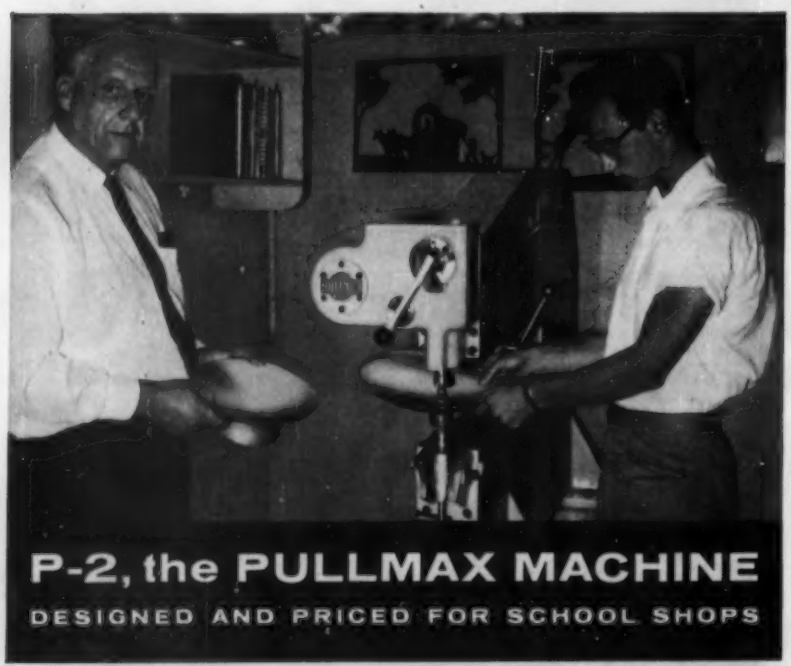
After trying tables, percentages, charts and diagrams, I came upon the "space box" which I find a most successful aid in presenting the spacing unit to new classes. Constructed entirely of wood, the spaces are enlarged considerably and painted in different colors. The entire set, consisting of 2-em quads, 3-em quads, em quads, nut quads or figure spaces, 3-em, 4-em, and 5-em spaces, fits compactly into the box for easy storage.

Presentation may vary with each instructor, but I have used the "space box" successfully from grades seven through twelve. It may be shown first as a visual breakdown of the spacing units and then used as a drill with a prize of a few scratch pads or tablets going to the winner as incentive. (The seventh and eighth graders appreciate this technique immensely.)

It is a versatile aid, in that various combinations of spaces can be demonstrated before the entire class instead of the usual individual presentation, thus saving sorely needed time for other activities. The difference between one 3-em space and two 3-em spaces can be seen by the entire group, leaving nothing to the imagination. Demonstrating that three 3-em spaces equal one 1-em quad requires nothing more than picking up the three spaces in one hand and matching them up with the em-quad right before the class.

After a short lesson on spacing material using the "space box" as my teaching aid, I find the student retaining much more of the new information than he did previously with only the charts and diagrams as aids.

Fred Sherwyn
Instructor, Printing
Los Angeles, Calif., High School



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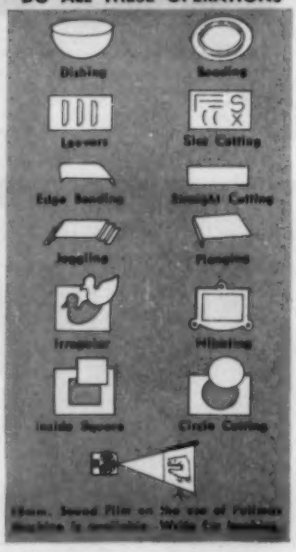

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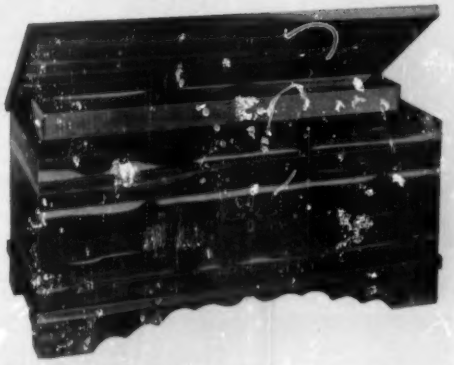

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DETROIT INDUSTRIAL EDUCATION SOCIETY

One hundred Detroit teachers of industrial arts, vocational and special education shop teachers have formed the new Detroit Industrial Education Society.

Publicizing industrial education, exchange of ideas, solution of common problems and broadening the outlook of teachers are some of the areas in the planning stages.

Officers are: president, Stephen Wichar, Keating School of Detroit; vice-president, Raymond Hughes, Garfield Junior High at Detroit; secretary, Michael Wichorek, and D. Houghton, both of Detroit; secretary-treasurer, John Blaschak, Cass Technical High School, Detroit.

Directors are: Harold Hill, Miller Junior High School; Melvin LeRoy, Washington Trade School, and Herbert Piilo, Post Junior High School, all of Detroit.—*Michael Wichorek, secretary.*

NEW ENGLAND IA TEACHERS TO MEET

The 23rd annual convention of the New England Industrial Arts Teachers Association will be held on October 14 and 15, 1960, at Wentworth By The Sea, Portsmouth, N. H.

The theme of the 1960 meeting will be "Crucial Issues Facing Industrial Arts Today."

Dr. Donald Maley, head of the department of industrial education, College of Education, University of Maryland, will be the keynote speaker on Friday afternoon.

George Koenig, head of the U. S. Navy's Bureau of Ships Training Program, will speak on "The Collapse of Time," at the main banquet.—*George F. McKeague, publicity.*

COMING CONVENTIONS

Oct. 7–8. Ohio Vocational Association, at Southern Hotel, Columbus, Ohio. Exhibit chairman, C. O. Tower, 3520 Central Parkway, Cincinnati 23, Ohio.

Oct. 14–15. New England Industrial Arts Teachers Association, at Wentworth by the Sea, New Hampshire. Secretary, Edward P. Stach, Warren Harding High School, Bridgeport 10, Conn.

Oct. 20. North Dakota Industrial Education Association, at Grand Forks. President, Robert V. Echelbarger, The Crippled Children's School, Jamestown, N. Dak.

Nov. 4–5. Kentucky Industrial Education Association, at Kentucky Hotel, Louisville, Ky. John D. Rowlett, associate professor of industrial arts, Eastern Kentucky State College, Richmond, Ky.

Nov. 10–12. Oregon Industrial Arts Conference, at Benson Polytechnic High School, Portland, Ore. Secretary, Miss M. Hallock, 546 N.E. 12th Ave., Portland 12, Ore.

Dec. 4–7. American Technical Education Association, at Biltmore Hotel, Los Angeles, Calif. Secretary, William N. Fenninger, 22 Oakwood Place, Delmar, N. Y.

Dec. 5–9. American Vocational Association, at Biltmore Hotel, Los Angeles, Calif. Secretary, M. D. Mobley, 1010 Vermont St., N.W., Washington 5, D. C.

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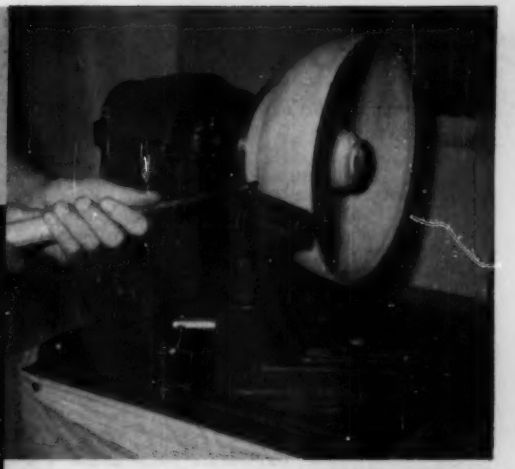

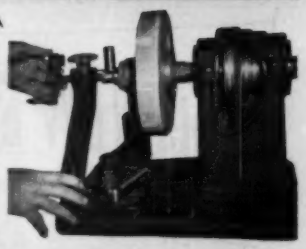

DuaLathe set up for face plate turning.

DuaLathe showing tail stock mounting for metal spinning. (Plate covers pulleys when motor is mounted beneath machine.)

DuaLathe set up for metal spinning.

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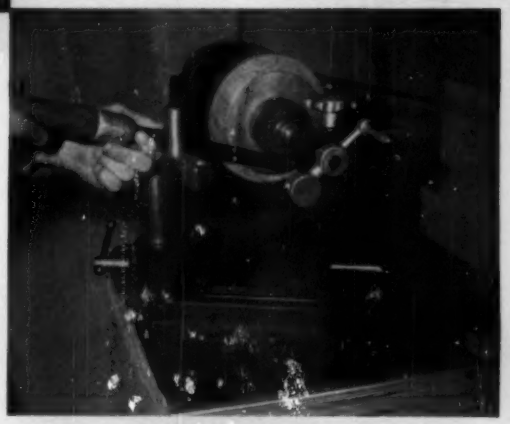

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Pocket Encyclopedia of Paper and Graphic Arts Terms

Pocketbook edition, cloth, 92 pp., 3⅝ by 6¼ in., $1. Thomas Printing and Publishing Co., Ltd., Kaukauna, Wis.

This useful dictionary provides a surprisingly complete list of terms in the fields of paper and papermill making, printing, and the graphic arts, the carton and boxboard industry, and ink. The definitions are informal, but accurate. An old timer will miss such terms as "demy," "brevier," "agate," and "double tone." The book will make a good addition to the school printshop library.

Photo Offset Fundamentals

By John E. Cogoli. Cloth, quarto, 209 pp., $4.80. McKnight & McKnight, Bloomington, Ill.

The author, who is graphic arts instructor in the Hartford, Conn., high school, has here presented the fundamental processes of lithographic printing, now commonly termed photo-offset printing. The book is written in logical manual form, with careful definitions of terms, and detailed descriptions of materials, processes, and tools. The preliminary chapters, devoted to a history of the craft and the industry, provides much information on job planning and layout, type composition and proofreading, before getting into the actual work of offset printing — photography, film development, workroom work, laying out, stripping, and platemaking. The actual processes are at this point interrupted to describe inks and papers suited to offset work. Presswork operations and difficulties are detailed in three well balanced chapters. The final chapters and the appendices take up shop safety and legal aspects of copying existing printed and official materials, the mathematics and measurements of graphic arts, instruments and instrument use, etc. The several chapters include excellent teaching aids in the form of problems and questions, nomenclature, and a bibliography.

Technical Illustration

By T. A. Thomas. Cloth, 149 pp., 8½ by 11⅛ in., illus., $6.50. McGraw-Hill Book Co., Inc., New York, N. Y.

This book emphasizes practical, rather than theoretical techniques. It discusses the basic procedures used by industry to make three dimensional drawings. Several chapters are devoted to a description of special mechanical equipment and its use. Numerous drawings illustrate procedures in a step-by-step fashion.

The book can be used as a classroom text, and is adaptable to the needs of beginning, intermediate, or advanced students. Also meant to serve as a useful home study guide, reference, and handbook for those who are employed as technical illustrators, technical writers, or commercial artists.

Electrical Technology

Paper cover, 118 pp., 7⅞ by 10¼ in., 75 cents. U. S. Department of Health, Education, and Welfare, Washington 25, D. C.

Electronic Technology

Paper cover, 97 pp., 7⅞ by 10¼ in., 70 cents. U. S. Department of Health, Education, and Welfare, Washington 25, D. C.

These two bulletins have been prepared to suggest post high school curriculums in the broad fields of electrical and electronic technologies. They are designed to illustrate types of full-time, 2-year preparatory programs which can provide certain basic education for entry jobs in these fields in support of engineers and scientific personnel, entrance into apprenticeship programs with the possibility of advanced standing, or other beginning work. They are not designed to prepare students for a specific job. They contain curriculums, course descriptions to develop the curriculums, and some suggested physical facilities layouts.

The material should be helpful to administrators, supervisors, teacher trainers, and teachers in the promotion and development of new programs.

Theory and Practice of Arc Welding — Second Edition

By Raymond J. Sacks. Cloth, 478 pp., 7 by 9¾ in., illus., D. Van Nostrand Co., Inc., Princeton, N. J.

This textbook presents an original course of study in arc welding theory and practice in accordance with the current practices in industry and the recommendations of the American Welding Society. It has been planned specifically to be of use in industrial training programs, vocational schools, technical schools and colleges, and has value as a reference book and text for courses in welding, building construction, metal working, and industrial arts.

It is meant to aid both the beginning and the advanced student and those journeymen in the metal working trades interested in welding as a supplementary tool. The second edition has been revamped to bring it in line with current practice.

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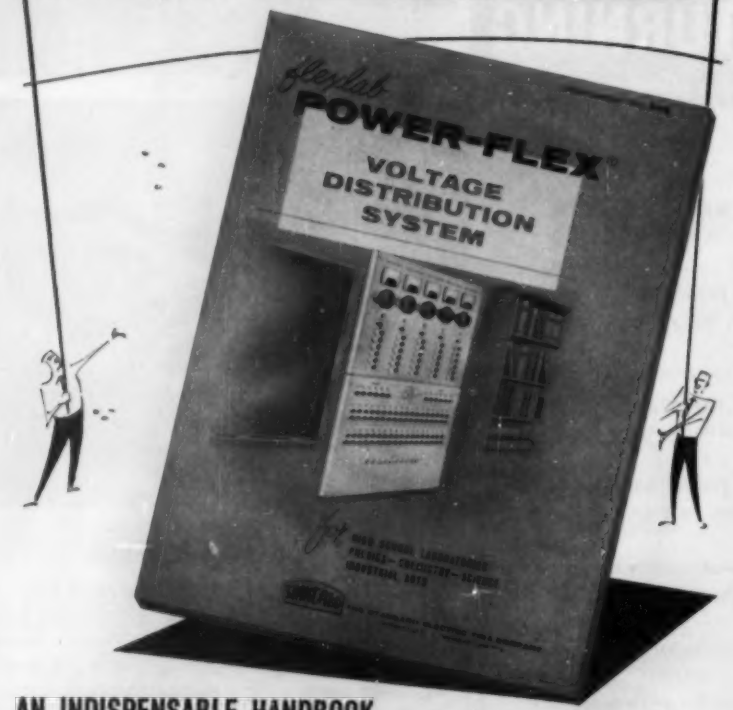

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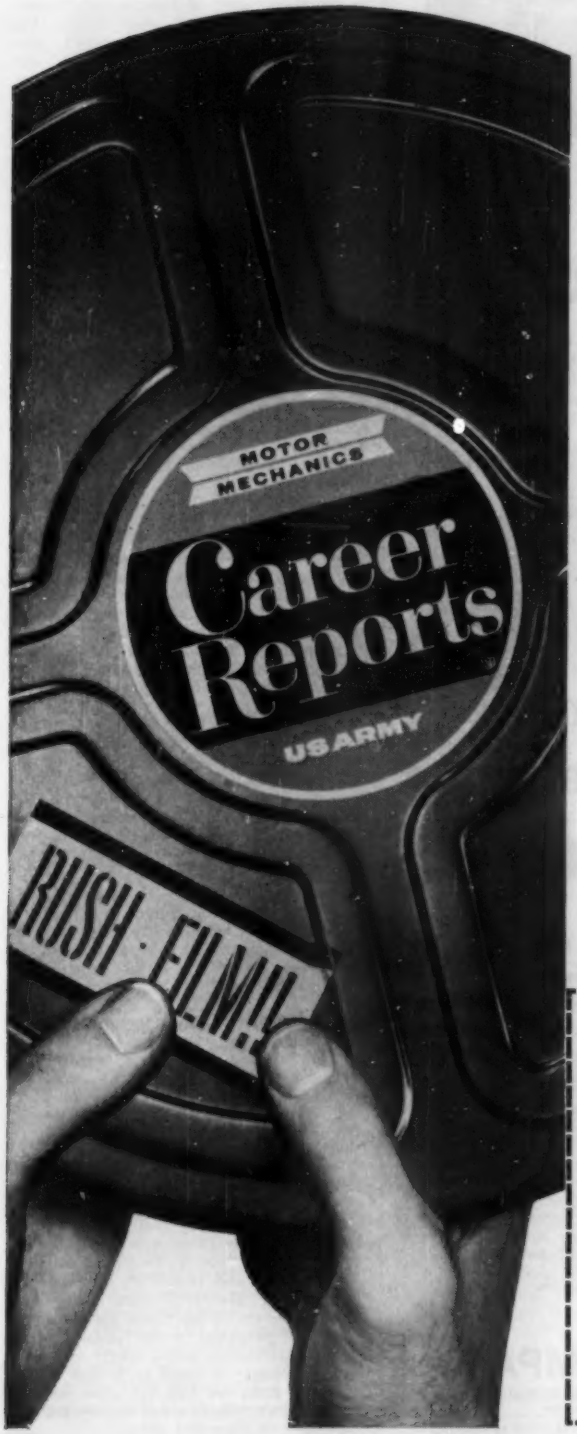

A new solution to a serious guidance problem. The secret of getting ahead is planning ahead. For seniors in search of a career, it's essential to know the pros and cons of an occupation before selecting it. But until now, visual guidance materials have been sorely lacking to help you counsel one large category of young men—the seniors who aren't able to go on to college. Career Reports is a new series of motion pictures created to fill this serious gap in the average vocational guidance program.

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Who sponsors this project? Career Reports is sponsored by the Department of the Army, with cooperation from the American Personnel and Guidance Association, and other recognized vocational authorities.

What is the Army's purpose? Each film in the series conveys a distinct axiom: training is indispensable to success in any skilled occupation. Beginners can acquire this training in one of several ways—on the job (by means of formal or informal apprenticeship), through a trade school or company training program, or in the Armed Services. The Army's purpose is achieved simply by being recognized as one of the possible ways in which a young man can secure essential vocational training.

An early reservation is advisable. For the first time, a comprehensive guidance tool has been prepared specifically for high school graduates not able to go on to college. The Career Reports series is available (without charge) to teachers and guidance counselors in the United States. Reservations must be made early in order to incorporate Career Reports into your guidance program for the coming academic year. May we therefore suggest that you mail the coupon today for free details.

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teaching aids

let's study math "Why should I study mathematics?" is the question answered in the Department of Labor's "Mathematics and Your Career," which shows that math is not farfetched for someone "who doesn't plan to become an Einstein." Delightful cartoons and a list of "Occupational Outlook Handbook" references to indicate importance of math in specific employments. For information write the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

space flight Intended for use by cadets in Civil Air Patrol Aviation Education, "The Dawning Space Age" is excellent supplementary material for interested i-e students. Outlines recent experimentation with guided missiles, rocket engines; considers flight into space. Historical data and splendid illustration. Two dollars from the Civil Air Patrol, Ellington Air Force Base, Ellington, Tex.

color printing "The First Book of Color," a classic primer on color. Suitable for graphic arts students training for or interested in full color reproduction, $1.95 from the book department of the Graphic Arts Monthly, 600 S. Dearborn St., Chicago 5, Ill.

stay in school Very simple four-page leaflet emphasizing the fact that there are "more and better jobs for (high school) graduates." Effective answer to the eternal question, "why stay in school?" Write Superintendent of Documents, U. S. Government Printing Office for the Department of Labor's leaflet No. 8, "Stay in School!"

on forest products Excellent supplementary material in woodworking classes is available from the Forest Products Laboratory, U. S. Department of Agriculture, Madison 5, Wis. Bibliography of publications July 1 to December 31, 1959, lists new reports on wood, properties, pulp and paper, paints and finishes, etc.

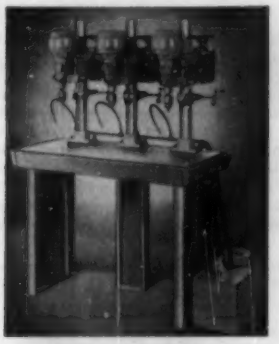
slide rule instruction Free of charge, a 48-page "Teaching Guide for Slide Rule Instruction." Complete treatise with 12 sections which can be applied to classroom and shop use. Write Pickett and Eckel, Inc., 543 S. Dearborn St., Chicago 5, Ill.

T & I for girls Comprehensive directory of training programs by schools and courses for girls and women prepared for counselors and teachers. Thirty cents for "Trade and Industry Program for Girls and Women" from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

film sources A 20-page bibliography of lists of free or rental films from a variety of sources is available free from the Sales Service Division, Eastman Kodak Co., Rochester 4, N. Y. Under the category of "business and industry" for instance, "Sources of Motion Pictures and Filmstrips" lists the "Film Guide for Industrial Training" published by the National Metal Trades Association which selects over 2400 films covering 75 subjects having special training. Data on film etiquette, how to get them, etc., Superb tool for i-e teachers interested in films and strips.

equipment

sectional table model production drill press The production drill press demonstrates South Bend Lathe Company's new sectional tables. Through the

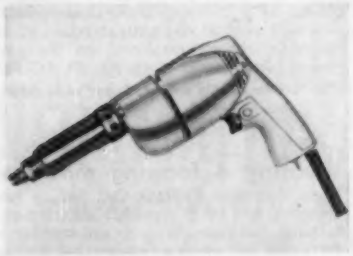


Sectional Table Model
Production Drill Press

use of multiple sections, and corresponding ends and legs, it is possible to assemble tables of any length to accommodate multiple head and column assemblies, work fixtures, etc. Table sections are easily assembled. End legs and inner legs have leveling bushings and pads.

(For further details encircle index code 0801)

electric drivers From Skil Corp., two new electric drivers with anti-ratcheting clutch for fast, quiet, continuous, uniform fastening. Precise torque for production screw driving or nut running operation easily set externally; when the pre-set



Skil Model 272 Driver

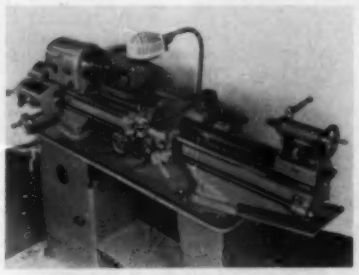
torque is reached, all driving action stops instantly regardless of operator pressure for uniform tightness on the most exacting assembly work. Assembly model (235) and reversing model (272) usable for disassembly both have capacities of ¼-in. machine screws and nuts, No. 12 self-tapping screws, and No. 12 wood screws. Model 272 has extra torque in reserve to speed up removal of fasteners. Both models feature: trigger switch; pin for locking in "on" position; permanently lubricated ball and needle roller bearings; die cast aluminum housing; quick-change finder, cord protector. Motors are 115 voltage (220 and odd voltages furnished on order at no extra cost) universal d.c. or a.c. up to 60 cycles. 12 1/16 in. long; 4½ lb.

(For further details encircle index code 0802)

new rubberized paint From Pittsburgh Plate Glass Company, a new exterior rubberized paint for all surfaces — wood siding, shakes and shingles, asbestos siding and shingles, stucco, brick, concrete, masonry, and metal — developed by their paint division, the product to be known as "Pittsburgh Latex House Paint." Thoroughly field-tested in all climates, the new paint is made with glass-clear latex resins, possesses great durability, and may be applied over surfaces dampened by rain showers or morning air. It dries bug-free and dust-free in 30 minutes. A second coat may be applied on the same day.

(For further details encircle index code 0803)

metal cutting lathe From Rockwell Manufacturing Company's Delta Power Tool Division their new "long bed" model 10-in. metal cutting lathe, with a capacity of 36 in. between centers. This model features the variable-speed drive, ¾-in. collet capacity and all other features of Delta's standard 10-in. metal lathe introduced last year. Designed to fill the

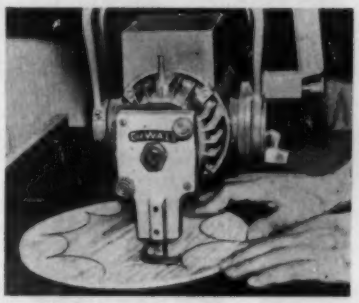


New Delta Long Bed
10-in. Lathe

need for a low-cost lathe to do heavy-duty work in commercial metalworking shops, plant maintenance shops, toolrooms, and other industrial operations, the new lathe is compact, modern looking and easy to operate. Included are two new safety accessories — a magnetic starter electrical disconnect switch kit which automatically shuts off the motor when headstock cover is swung open, and a mechanical back gear lock-out kit which protects the gears of the headstock because it forces the operator to raise the headstock cover before the back gears can be engaged.

(For further details encircle index code 0804)

new saber saw attachment From DeWalt, Inc., a compact saber saw attachment capable of doing curve work at any angle, and designed for use on its home workshop line of radial-arm power tools. Weighing only 23 ounces, it measures



New Saber Saw Attachment

about the size of an average hand, is a rugged performer on soft or hardwoods, composition materials or plastics, aluminum, and even light gauge steel. Cutting capacity up to 2 in., in thickness, the mechanism does not contain any gears or pulleys, and delivers 3600 strokes per minute. Two locating pins, two clamping screws, and the machine arbor nut, hold it securely in place. A spring hold-down assures safe, accurate operation, and a floating hub mount adjusts automatically, when tightenting the arbor nut, thereby avoiding misalignment. The unit is fully counterbalanced to minimize vibration.

(For further details encircle index code 0805)

hobby-craft material From Future Chemicals, this new art material, "Copy-Cast," can be molded, shaped and carved, or it can be used to make molds of shapes which can then be duplicated in those same molds with more "Copy-Cast." Fine grain texture enables this product to pick up finest detail; it can be shaped and sculptured with woodworking tools. An added adhesive ability enables it to be used as a repair material, or as bonding directly to any material — metal, wood, glass, tile, etc.

(For further details encircle index code 0806)

(Continued on next page)

vacuum tube voltmeter model

From Electronic Instrument Company, an excellent example of a visual aid, their 23 by 14¾-in. rugged, easy to operate, demonstration model. Adaptable to classroom utilization, it is invaluable in teaching the uses and operation of this instrument. This demonstration model of EICO's vacuum tube voltmeter may be used by the students themselves to enhance the learning situation, stimulate their interest, and maintain the motivation of the group to reach to the goals of the lesson. Among other benefits, actual experience with a device like a VTVM (even a simulated VTVM) will prevent many a student from damaging the first real one he tries to use.

Vacuum Tube
Voltmeter Model

(For further details encircle index code 0807)

(For more information from advertisers, use the postcard on page 91)

SHOP EQUIPMENT NEWS

(Continued from previous page)

new machine for shop finishing operations

From Rockwell Manufacturing Company's Walker-Turner Division their new combination belt and disk finishing machine. Ideal for grinding, surfacing, or polishing steel components, die castings, aluminum, brass and copper parts, and a variety of other materials, it can also handle finishing operations on wood and plastic. Its features include a 4¼ by 12-in. platen that can be inverted for underside general finishing or deburring operations on small, hard-to-handle parts; removable end guard to permit inside contour finishing operations on the idler drum; a 9¾ by 16¼-in. table furnishing ample work support for finishing large patterns; and a fully machined disk balanced for vibration-free operation assuring accurate finishing on close-tolerance patternmaking operations.

(For further details encircle index code 0808)

Walker-Turner Belt and Disk Finishing Machine

knight kn-500X stereo magnetic cartridge

From Allied Radio Corporation the new Knight KN-500X Stereo Magnetic Cartridge. Patterned after the popular KN-500 cartridge, the KN-500X is designed for use with professional-quality record-playing equipment at low tracking pressures (1–4 grams). Special features include: 4-coil, moving-magnet design; .0005-in. diamond stylus for precise tracking and minimum high-frequency distortion; effective mass of less than ¼000th of an ounce for greatly reduced record wear; 8-way, mu-metal shielding to prevent hum; frequency response of 20 to 20,000 cps, plus/minus 2 db; channels precisely balanced to within plus/minus 1 db; compliance 5.5 x 10^{-6} cm/dyne; channel isolation well over 20 db; with standard ½-in. mounting centers employed on the cartridge. Listed under stock No. 89 RC 225.

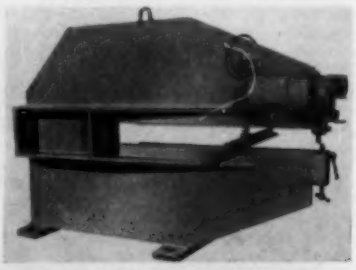
(For further details encircle index code 0809)

Knight Model KN-500X Stereo Magnetic Cartridge

shearing & forming machines

From American Pullmax Co., Inc., a new economy line of 5 universal shearing and forming machines. With prices starting at $400, this line offers an economical method of straight, circular and irregular shearing, plus slotting, folding, beading, joggling, edge bending, and louver cutting. Pullmax machines range in capacity from 14 gauge

(Continued on page 84)



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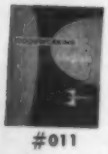

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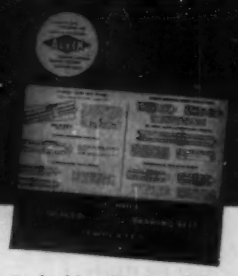

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SHOP EQUIPMENT NEWS

(Continued from page 82)

up to 7/32 in., in mild steel. Machines are built to the finest precision standards, frames are made of solid reinforced, heat treated steel plate. Pullmax machines are used in sheet metal shops, schools, engineering departments, model shops, and in plants where small production runs on a Pullmax eliminate costly dies.

(For further details encircle index code 0810)

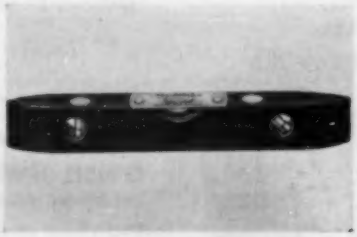
band saw blade From The L. S. Starrett Company, a double carbide special alloy band saw blade, especially for standard cut-off band saw machines which cuts 50 per cent faster than carbon bands and enables standard band saw machines to operate at close to maximum efficiency.

Double Carbide Special Alloy Band Saw Blade

Also cuts a wider range of metals including tough alloy steels and results in greater blade life with reduced down time for blade changing. Starrett Alloy Band has improved hot hardness and abrasion resistance, permitting the use of higher speeds and heavier speeds on standard band saw machines. With the range of materials that can be cut with this band extended to include many tougher steels, the need for expensive special cut-off equipment is often eliminated, achieving a sizable saving in costs.

(For further details encircle index code 0811)

torpedo levels From The Columbian Vise & Mfg. Company, restyling of the two leading hardwood torpedo models. Levels No. 209 and No. 309 feature a new con-



Restyled Torpedo Levels

tour shape, streamline design with slim end points, said to facilitate carrying of levels in pockets. Levels are made of natural finish hardwood with aluminum top plates, 3/4 in. wide (at widest point), 1 1/4 in. high, and 9 in. long, No. 209 has 1 plumb and 1 level. No. 309 has 1 plumb,

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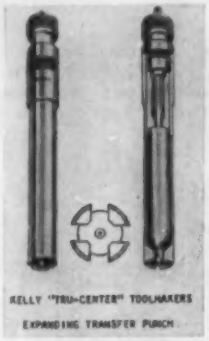
(For further details encircle index code 0812)

toolmakers transfer punches

From Kelly Tool & Mfg. Company, the Kelly "Tru-Center" Expanding Transfer Punches, to make possible the securing of Tru-Center accuracy when using a toolmakers tool punch. Through the expanding feature, a set of three Kelly punches have



a size diameter range from 1/16 to 11/16 in. With transfer accuracy desired in thousandths, the three Kelly punches cover a range of 437 thousandths. Kelly Expanding Punches are used in the conventional way, by inserting a punch in the drilled hole, turning the knurled head, then a hammer stroke on the top of the center pin secures

(Continued on next page)

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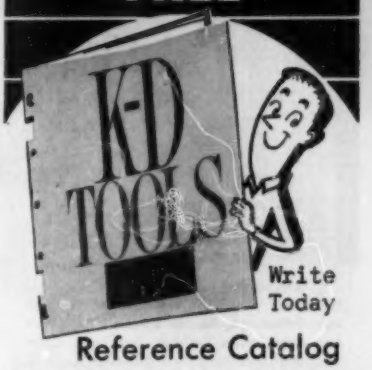

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School Address .....
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"Educational Publishers Since 1899"

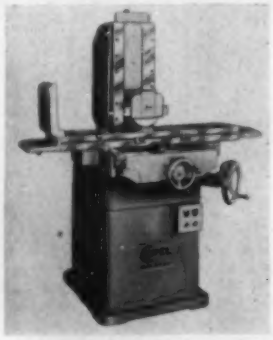
SHOP EQUIPMENT NEWS

(Continued from previous page)

the desired "Tru-Center" mark. The Kelly Punch is removed by reversing the Knurled Nut and retracting the expanded body. Made of best grade tool steel, hardened and ground, No. 300 Kelly Punch Set is available in 3 sizes: No. 301 — ¼ to 5/16 in.; No. 302 — 5/16 to 7/16 in.; No. 303 — 7/16 to 11/16 in., in hardwood pocket size case.

(For further details encircle index code 0813)

surface grinder From Covel Manufacturing Company, No. 10P Hand Feed Surface Grinder with Power Assist, using hydraulic power responsive to finger tip

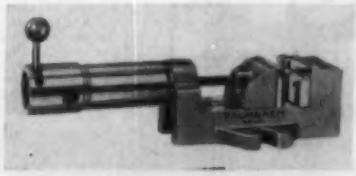


No. 10P Hand Feed Surface Grinder

touch such as is used for the power steering of an automobile, and set up the same as for a conventional hand feed machine. Grinding work capacity 6 by 18 by 16½ in., grinding wheel size 7 by ½ by 1¼ in., spindle direct motor drive 1 h.p., 3450 r.p.m., table speed 0 to 50 ft. per min., floor space: at right angle to spindle 79 in., or parallel with spindle 50 in., net weight 2260 lb.

(For further details encircle index code 0814)

air vise From Chicago Tool and Engineering Company, its new Palmgren Air Vise, Model No. 121. Designed to answer the problem of speeding up light drilling,

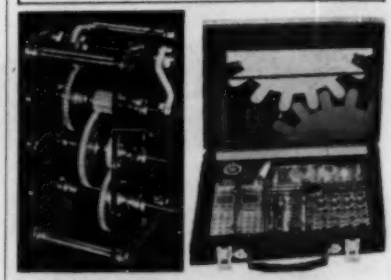


Palmgren Air Vise Model No. 121

tapping and assembly work, it has a jaw width of 1½ in., a jaw opening of 1½ in., a jaw depth of 1 in., and is only 1¾ in. high overall, and is equipped with a 1⅛-in. diameter stainless steel air cylinder with adjustable stroke. The air cylinder and valve are combined in one compact unit only 1⅛ in. in diameter and the overall length of the vise and cylinder is just 8 in. Any available air supply will operate this vise.

(For further details encircle index code 0815)

"Portable Laboratories" for the Classroom



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FREE CLASSROOM WALL CHART ON FINISHING

A second printing makes these popular wall charts again available. Simply drop a line to Desmond Bros., Dept. IA, P.O. Box 2216, Torrance, Calif., giving your name, school and address. Charts will be sent by return mail.

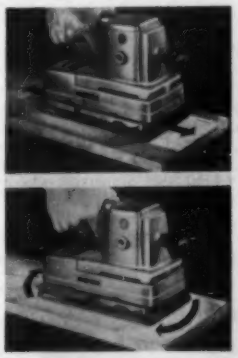
radial-arm machine From DeWalt, Inc., the new "1030" model radial-arm machine designed to follow the wedge styling which was introduced on DeWalt's "Power Shop" line recently. Professional

"1030" Radial-Arm Machine

model for use by small builders, cabinet makers, contractors, and schools. A new safety guard has also been introduced which directs the sawdust flow away from the operator and to the rear of the machine. New "eye-ease" green offers a change from industrial grey and is expected to help reduce operator fatigue.

(For further details encircle index code 0816)

orbital and straight line sander From Skil Corporation, a heavy-duty electric dual-motion sander, to do either orbital or straight line sanding work at the flick of a switch — Skil Model 692 Orbit/Line Sander. Designed for craftsmen in furniture and other woodworking industries, it is ideal also for maintenance, automotive, home, and school workshop needs. Sanding



Skil Model 692
Orbit/Line Sander

surface measures 4½ by 9 in., spring action levers hold six or more sandpaper sheets for easy paper change, flush side design of sander permits sanding up to vertical surfaces and in corners, top handle has contour grip and trigger switch with locking pin, weight of Model 692 is seven pounds, Model 693, seven and one half pounds, with dust pick-up unit.

(For further details encircle index code 0817)

professional drawing set From C-Thru Ruler Company, a new drawing set featuring a 13 by 19-in. drawing board

(Continued on next page)

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- ☐ Red Maple
- ☐ Natural Walnut
- ☐ Brown Walnut
- ☐ Natural Oil
- ☐ Gray Walnut
- ☐ Teak Wood on Wal.
- ☐ Antique Platinum
- ☐ Bisque
- ☐ Blende
- ☐ Nut Brown Walnut
- ☐ Red Mahogany
- ☐ Antique Distr's Pine
- ☐ Pickled Pine
- ☐ Medium Red Cherry
- ☐ Red Cherry
- ☐ Old Cherry
- ☐ Transitional
- ☐ Natural Mahogany
- ☐ 18th Century Mah.
- ☐ Brown Mahogany
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SHOP EQUIPMENT NEWS

(Continued from previous page)

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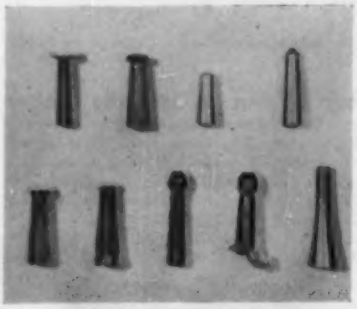
plus 14 widely used drawing and calculating instruments, including the engineer's scalemaster that eliminates cumbersome triangular 3-sided scales, the C-Thru slide rule, a bow compass, a T square, lettering guide and other drawing and calculating aids, packed attractively.

(For further details encircle index code 0818)

decorative new ferrules From Wilkenson Manufacturing Company its new line of ferrules styled and finished for furniture of almost any design. They are available in a variety of finishes: satin



Wilkenson Ferrules in a variety of styles

brass, polished brass, pewter, chrome, copper, and others on order; also with gold plating, in addition to its extensive line of legs, glides, ferrules and brackets, for use in school and industrial woodworking shops, as well as for furniture manufacturers. Every ferrule has a hole at the top for easy insertion of a brad.

(For further details encircle index code 0819)

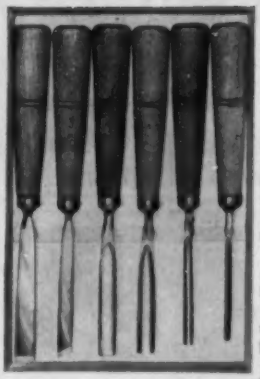
Descriptive Materials . . .

From Rockwell Manufacturing Company's Delta Power Tool Division, a four-page, illustrated bulletin describing the new Delta combination finishing machine now available for use in wood and metal pattern shops, sign and display shops, all types of commercial shops through industry, plus schools and even in well equipped home workshops. Bulletin AD-1224. In addition, a six-page, two-color, bulletin No. AD-1201, which illustrates and describes the new 14-in. variety saw to be used for wood and plastic products.

(For further details encircle index code 0820)

From Challenge Machinery Company, a new, free, booklet entitled "Planning Your Graphic Arts Shop." Includes complete descriptive information, prices on various models of paper cutters, proof presses, paper drills, folding machines, and composing room equipment suitable for school

Importers of top quality CARVING TOOLS



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Six tools in serviceable box. Round hardwood handles. Set consists of Chisel No. 101 12 mm. Skew chisel No. 102 8 mm, Gouges No. 104 10 mm, No. 105 10 mm, 3 mm and V tool No. 106 3 mm wide. Sharpened need only honing for keen lasting edge. Complete Set, boxed $9.50

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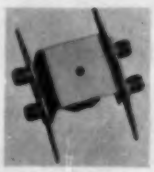

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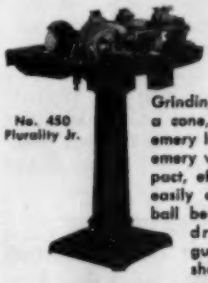

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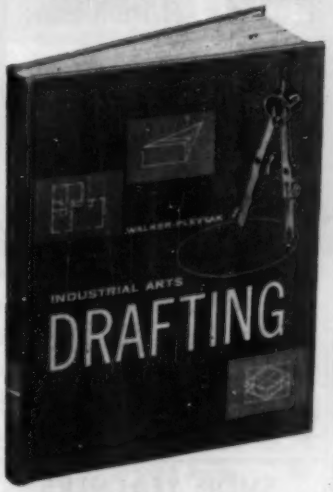

This new text (published Jan. 1960) has already been requested by more than 1600 schools! If you teach drafting, especially to beginners, you owe it to yourself to examine this book. Send for your Examination Copy on 30 Days Approval TODAY.

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use; also includes a handy selector guide on these types of school shop equipment. Publication No. 609A.

(For further details encircle index code 0821)

From Electronic Instrument Co., Inc., an illustrated, four-page booklet entitled "Stereo and High Fidelity" which presents in addition to a clear definition of stereophonic sound, a discussion on the stereo sources of live broadcasting, stereo disks, stereophonic systems using all stereo components, or all monaural components, or both, a review of design principles of stereo components, an analysis of the EICO HF-81 Stereo Dual Amplifier-Preamplifier and the HF-85 Stereo Dual Amplifier, with a section included on phono cartridges. Other detailed information.

(For further details encircle index code 0822)

From South Bend Lathe, Inc., a 96-page catalog showing the complete line of South Bend engine lathes, toolroom lathes, turret lathes, milling machines, shapers, drill presses and pedestal grinders, with a listing of tools, attachments, and accessories for use with various machines. Complete specifications, feature descriptions, and prices included to facilitate selection of sizes and types of machines. Includes nearly 500 illustrations.

(For further details encircle index code 0823)

From V. & E. Manufacturing Company, Catalog 60-DI, containing information on their stainless steel and nickel-plated steel 6½-in. compasses, 6½-in. speed bow compasses, 4½-in. and 4-in. compasses, and pen compasses; pen attachments; beam compasses and beam attachments; friction dividers; drop bow compasses; and a broad range of ruling pens.

(For further details encircle index code 0824)

From Brown & Sharpe Manufacturing Company, an 81-page book entitled "Cam and Tool Design" for automatic screw machines, contents consisting of a series of articles written by Oscar T. Lippman, instructor on this subject for over 20 years.

(For further details encircle index code 0825)

From The Columbian Vise & Mfg. Company, 2 bulletins descriptive of new aluminum levels, made in both 4-vial and 6-vial types both with full size die cast frames, and 24-inch rules along the top edge. Bulletin LL-8441 on 4524 levels, and Bulletin LL-8442 on 6524 levels.

(For further details encircle index code 0826)

From Covel Manufacturing Company, bulletin No. 35B60 describing the No. 35B 8 by 24-in. hydraulic surface grinder. This six-page folder gives full details and specifications, high lighting its built-in accuracy, high speed, versatility, and rugged construction.

(For further details encircle index code 0827)

From Allied Radio Corporation, their new 1961 general catalog featuring a large selection of electronic parts and equipment for use in schools, classrooms, laboratories, and shops. Catalog of 444 pages lists over 40,000 items and includes 240 pages in rotogravure. Covers reproduced in 4 colors. Free.

(For further details encircle index code 0828)

From the Challenge Machinery Company, a new publication (F-800) describing three new and improved models of table-type folding machines designed to provide an answer to the folding needs of many printing plants and duplicator operators. These new folders are capable of handling single and double parallel folds on sheets up to 17 by 22 in.

(For further details encircle index code 0829)

Automotive Instructors!

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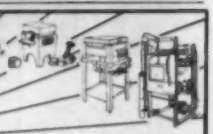

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The LEATHER CRAFTSMAN
P. O. Box 1386-V, Fort Worth, Texas

from the field

The Black & Decker Manufacturing Company has opened a third factory service branch in The Bronx at 2421 Westchester Avenue, and is equipped to render prompt repair service and to supply replacement parts on all Black & Decker products. Carl F. Johnson is service manager of the Bronx Branch. . . . **Black & Decker Mfg. Co.,** have announced recent appointments to their sales organization:

Larry H. Frazier, industrial-automotive sales representative in the Los Angeles district, replacing Ralph W. Long who has resigned; Robert E. Miller, industrial-automotive sales representative in the Chicago district.

Disston Division, H. K. Porter, Company, Inc., have appointed Charles E. K. Fox plant manager at their Danville, Va., Works.

The Electric Hotpack Company announce the appointment of Allyn H. Jacobson as advertising manager.

Thermo Electric Manufacturing Company have announced their change in corporate name to: **Thermolyne Corporation.** The charter, ownership, management, policies and personnel of this company all remain the same.

Wilton Tool Mfg. Co., Inc., is expanding its Schiller Park (Illinois) plant for the second time since the plant was constructed five years ago. The new addition is being constructed at a cost of $100,000 and will add 12,000 square feet for additional manufacturing facilities.

Brodhead-Garrett Co., have announced new representation on the west coast. Tony Manne has joined the company, after spending 3 years teaching at Chico State College.

The Black & Decker Mfg. Co., have developed an intensified program of marketing research in two of its electric tool product divisions and have appointed two new members of the Marketing Division to supervise these studies. Richard T. Scott is market research representative on special assignment to conduct the marketing study with relation to the company's hardware line products, and J. Howard Foote is market research representative on special assignment to study distribution and marketing in the automotive division.

DeWalt, Inc., has appointed two district managers to its Pittsburgh and northern New Jersey sales territories, effective August 1. Frederick B. Smith will be responsible for sales activity in northern New Jersey, and Marlin S. Miller will be responsible for the sales territory to include western Pennsylvania and eastern Ohio, with headquarters in Pittsburgh.

The Frederick Post Co., Chicago manufacturer and distributor of drafting equipment and engineering supplies, recently broke ground for the construction of a 60,000-square ft. woodworking plant at Owen, Wis.

The L. S. Starrett Co., Athol, Mass., announced the passing on April 26 of William J. Greene, retired vice-president and director of sales. Mr. Green served Starrett 42 continuous years, retiring in 1956.

The Black & Decker Mfg. Co., Towson, Md., has moved its Salt Lake City Factory Service Branch to 1541 S. Second West St. The move makes convenient factory-operated facilities for the repair of Black & Decker electric tool products available. Mr. Ralph W. May is service manager there.

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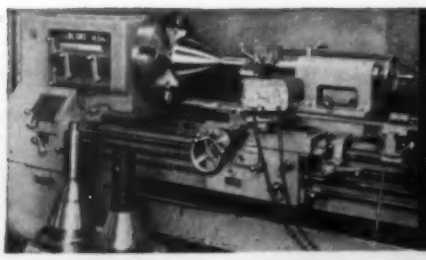

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